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# THESIS

**BUILDING A FOUNDATION FOR THE IMPLEMENTATION OF AN ENTERPRISE ARCHITECTURE FOR THE ARGENTINIAN ARMY**

by

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June 2016

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**13. ABSTRACT (maximum 200 words)**

Every organization has four layers that connect its vision, goals, scopes and ideals to their execution through the data, processes, applications and technology used. In recent years, technology has been considered as the answer to every problem. For every problem, technology could find a particular solution. Different results, however, have been obtained by many organizations. Many enterprises that initially were successful failed to maintain the pace; others managed to thrive in an increasingly competitive environment made up of an increasingly demanding public.

Recently, some methodologies have been developed to assess how an organization can improve its overall performance and gain capabilities. In this way, an organization is less flexible but stronger and more agile. This can be done by getting a holistic view of the organization and achieving a blueprint, in order to align the four layers that compose an organization.

The purpose of this thesis is to explore how these methodologies can be implemented in the Argentinian Army, what benefits can be obtained from them and how they would impact the organization. The Argentinian Army wants to be a modern organization. Implementing modern organizational methodologies is a way to achieve the desired final state.

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**BUILDING A FOUNDATION FOR THE IMPLEMENTATION OF AN
ENTERPRISE ARCHITECTURE FOR THE ARGENTINIAN ARMY**


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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CIO | Chief Information Officer |
| EA | Enterprise Architecture |
| FEA | Federal Enterprise Architecture |
| IT | Information Technology |
| PA | Public Administration |
| TAFIM | Technical Architecture Framework for Information Management |
| TOGAF | The Open Group Architectural Framework |

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# I.    INTRODUCTION

## A.    BACKGROUND

Four architectural layers can be identified in the Argentinian Army. These layers are the strategic level, the business and operations process level, the applications and data level, and the network and technology level.

Forty-five years ago, the Argentinian Army incorporated the use of IT to manage information related to its processes. The amount of equipment and networks in use has increased significantly over the past 20 years. Some applications were developed to improve centralized processes and many individual solutions were applied to the areas of personnel, logistics, accounting and project management. There is now an intranet in use with some centralized applications and resources online. Although IT proved to be a valuable resource, an information environment culture has not yet been created.

The implementation of IT in the Argentinian Army resulted in numerous systems that are difficult to integrate and not as effective as needed. Currently, IT looks more like a collection of single functions (Argillander, 2012, p. 5) with some efforts to produce organizational centralized solutions. Shared information to make decisions effectively is hard to find and internal communications are inefficient. Documents and orders are still issued in a written form and voice communications are the most reliable way to obtain results.

Every organization that has followed the same path has had the same tendency towards complexity and poor business alignment (Argillander, 2012, p. 10). Additionally, every organization is confronted with a multitude of challenges. Some private and public companies face these challenges successfully. These companies linked strategy and action to build a solid foundation for execution around their processes, implementing and making use of the right architecture. Successful organizations built an automated IT infrastructure and digitized processes to implement the best business practices and improve the financial-management decision-support system and maximize profit, arriving at a final state in which the four layers of the organization are aligned.

The Argentinian Army's resources, functions and missions are related and performed in a complex way through a multiplicity of processes that have to be highly dependable, reliable and predictable. They constitute the organization's core capabilities and are a key component to transform the strategies formulated into action. Although they should be carried out in a natural and smooth way, effectiveness is actually achieved by the efforts of every element in the chain of command. There is a lack of alignment within the organization.

Based on private and public organization that solved the same problems, the Army can enhance its outcomes by assessing the current architecture, establish and define the one it needs, and finally, implement it.

## B.    PURPOSE

The organization of the Argentinian Army includes a superior command headed by the Chief of Staff and an arrangement that comprises a support structure—under the authority of the Deputy Chief of Staff Command and a training and readiness command—responsible for the combatant unit capabilities. The support structure has the following areas: doctrine and organization, research and development, logistics, intelligence, education, health, personnel and welfare, and communications and information. This organization has been imposed by the Minister of Defense. It is described in the Defense White Book (available online) and is common to the three armed forces.

The Argentinian Army can be viewed as a large network made of different entities, resources, activities and processes with many interlinked and connected dependencies and processes that produce and exchange large amounts of data. The organization has more than 50,000 active duty military personnel, plus the reserves, civilian employees, retired, and families (Libro Blanco de la Defensa, 2015). The Army is deployed throughout Argentina's 1.08 million square miles, plus Antarctica and two foreign countries (Cyprus and Haiti) as part of UN missions. It has also some military observers in different missions, military attachés, students in many countries and others. The combatant units are supplied with the necessary resources to perform different

functions and missions. The support elements include the following functions: personnel, logistics and budget. These functions are performed by the following specialties: Ordnance, Quartermaster, Medical Services, Veterinary Services, and Finance, among others. Their aim is the logistical support of all forces. These functions are executed with materials that allow supply effects, maintenance, transport of personnel and cargo, erection of temporary or permanent buildings, conservation and recovery of health personnel, and the supply and maintenance of livestock, among the most significant (Libro Blanco de la Defensa, 2015).

An IT infrastructure, digitized business processes and the decision about which processes must be well executed are the building blocks to implement an effective foundation for execution through enterprise architecture (Ross, Weill, & Robertson, 2006). This thesis will explore these areas that belong to the support elements of the Argentinian Army to assess what is needed to enhance the processes and assess which benefits can be obtained by implementing the right enterprise architecture. The thesis also seeks to estimate how it will impact command and control, considering it as the process and system that exercise authority and direction. Additionally, the thesis will also consider which metrics need to be used to evaluate benefits other than proficiency.

## C.    RESEARCH QUESTIONS

### 1.    Primary

Through the lenses of Enterprise Architecture, how can the Army use its current IT resources within the organization to improve the overall efficacy and efficiency of its processes?

### 2.    Secondary

- How will the selection and implementation of enterprise architecture impact the organization?
- How will the adoption of a foundation for execution enhance processes and activities of the Argentinian Army?
- Command and control encompasses the complexity of processes and systems that take place in the organization so commanders can

make decisions and evaluate their execution. How will the selection of an architecture affect this function?

## D.    EXPECTED CONTRIBUTION OF STUDY

The Argentinian Army's vision states that the force will be a modern one. Combatant procedures and equipment have the priority and are the first consideration. This thesis proposes to modernize the support elements by adopting modern management methods, techniques and technologies to select and implement an enterprise architecture that provides an holistic view of the entire organization, allowing processes and technology alignment, in order to make the most effective and efficient use of the limited resources.

## E.    SCOPE OF THESIS

This study provides background on enterprise architecture in both the private and public sectors. The analysis will focus on building a foundation for execution to attain an effective and efficient system. Additionally, the analysis will determine the key elements to achieve operational excellence and the pitfalls that could be found when implementing an enterprise architecture. The end results of this research will provide guidance for other defense and public organizations.

## F.    METHODOLOGY

The methodology used in this thesis included the following:

- Comprehensive literature review
- Selection of concepts and models that best apply to the scope of the thesis
- Organizational assessment of current state, proposal of a desired state and actions needed to reach it
- Analysis of the findings to identify common lessons learned

## G.    ORGANIZATION OF STUDY

Chapter II outlines the related concepts to enterprise organization, the classical approaches and the enterprise architecture methodology.

Chapter III is an analysis of the current organizational state of the Argentinian Army and architecture.

Chapter IV examines the possibility of adopting an EA methodology in the Argentinian Army.

Chapter V answers the primary and secondary questions of this thesis and provides recommendations for additional research.

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## II. DEFINITION OF TERMS AND CONCEPTS

### A. ENTERPRISE

An enterprise is an organization or a collection of organizations oriented on a goal, comprised of business, human resources and technological components, related by processes and information in a cooperative and collaborative environment, making use of means and resources (Bernard, 2012, p. 229).

To achieve complex goals, organizations are divided into smaller functional units. This approach is based on the theory of reductionism (Gallagher, Appenzeller, & Normile, 1999). Reductionism divides entire systems in terms of their individual, constituent parts and their interactions. This approach results in an analytical method to solve complex problems. It divides the whole into parts to achieve an individual solution, then regroups them and achieves a complete outcome. The assumption that the whole is the sum of the parts is not true; it will have features that none of the parts have, resulting in a more complex entity (Jones, 2000, p. 54). This is the first challenge enterprises face and it comes from their own nature.

As enterprises create more and smaller divisions to achieve their goals, complexity increases and new problems are encountered. The most remarkable are related to information and coordination. Information should be shared among units, but the units naturally create barriers, hardening the flow of information. The cooperative and collaborative environment requires units to work in a coordinated relationship in pursuit of the enterprise's goals. These barriers create a disjointed environment instead of a collaborative one. Units tend to differ from one another in the way they operate. In order to bypass this differentiation, integration efforts are needed.

"Enterprises have always been confronted with many challenges" (Op't Land et al., 2009, p. 6). The fast growth of new technologies that developed in the second half of last century introduced a faster-changing environment that resulted in the combination of business and IT, globalization, new business models, new resources and a new information culture driven by innovation and technological change. As a consequence,

enterprises have had to adapt to new challenges. Some of these challenges described by Op't Land's group are operations that become more complex and require additional capabilities that may not be readily available: mandatory regulations to follow imposed mainly by state regulations increased; the need to achieve competitive advantage and become the preferred option of their customers; the answers to the questions of "which technologies are relevant for the enterprise, which technology should be replaced and which technology could be" obsolete (Op't Land et al., 2009, p. 10); Op't Land's group includes as current challenges, outsourcing, as it "requires organizations to precisely understand and describe what needs to be outsourced as well as the implementation of measures to ensure the quality and security of the outsourced processes" and products; and the "stakeholders and their concerns". How do enterprises deal with this changing and challenging environment?

To face these challenges, survive and stand out, enterprises need to define themselves and organize. The reason for existence of an enterprise is given by its mission. The mission contains the supporting values and culture of an organization. The vision is the desired state of the organization, the final state aspiration intended to make the mission a real fact. Vision is realized through strategy. Johnson, Scholes, and Whittington (2008, p. 9) described strategy as the "chosen long term direction of an organization." Finally, the vision is concreted in terms of goals to achieve and strategy is concreted in policies (Op't Land et al., 2009, p. 15). Goals are general statements of purpose, while policies are statements that give direction towards the achievement of goals. Op't Land et al. related these terms and positioned them in three tiers (Figure 1).



Figure 1.    The Three Tiers of an Organization. Source: Op't Land et al. (2009).

Every organization has to deal with continuous changes and challenges in two environments, one internal and the other external, each with their particular characteristics. In order to overcome these challenges, adapt to the environment and succeed, organizations have made use of a classical methodology: strategy executed through programs. This classical methodology incorporates technology to produce the best outcomes, as will be described.

### 1. Strategy

In order to overcome the challenges, enterprises are forced to make decisions. Strategy is used for that purpose. Enterprises have to decide how to allocate their resources (people and means) to achieve their goals. Decisions on which direction to take according to the environment have to be made as well. Op't Land et al. described strategic management as "a combination of three main processes: strategy formulation, strategy implementation, and strategy evaluation" (Op't Land et al., 2009, p. 14). All management levels can be matched through them to enable the organization to achieve its desired outcomes. This is possible because the choices selected for the main direction of the organization are materialized in its strategy.

Although strategy is defined as the long-term direction, it is constantly progressing. The dynamic nature of the environment (always in a constant change) and modifications in the organization impose the strategy to be permanently adapting to those changes.

### 2. Programs

After the direction in which the organization will move has been decided, strategy has to be converted into action. This is achieved through the implementation and execution of programs. Programs define the necessary goals needed to benefit the organization. They come from the strategic level and are reached by means of multiple interrelated or single projects. Op't Land et al. (2009, p. 17) explains that the instruments available to implement programs are "governance, project management, portfolio management, and program management"; the author also describes how putting "strategy

into action is concerned with three major areas: organizing the organization, resources allocation, and change management".

### 3. Outcomes and Pitfalls

This classical approach developed by Op't Land et al. goes from the highest enterprise level's views (the vision and strategy) to more detailed and specific views (goals and policies) implemented through a multiplicity of programs, projects, activities and processes. All of them produce and require data and information and they are linked through networks and technology to adopt the required changes and achieve the organization's profit.

As a result, the following elements or levels can be identified in an organization:

- A strategic level

- A business and operations process level

- An applications and data level

- A network and technology level

The first two levels are related to the "organization's structure, processes, and relationships to support successful performance" (Op't Land et al., 2009, p. 17). The last two levels encompass the resources needed to support the vertical interactions between the other levels and horizontal interactions within the same levels

Unfortunately, problems arise when ideas have to result into action. Most of the bibliography focuses on how to get the best strategy, how to map it, successful strategy execution keys, and the many other resources that can be found, but the causes of problems are hardly covered.

Many problems can be found in every one of the levels mentioned. Op't Land et al. (2009, p. 21) described some of them located in the first two levels. On the first level, strategy and vision are stated ambiguously and can have many interpretations. Decision making is done at the wrong time. Solutions lack a strategic origin. On the second level, barriers between different units appear as a result of their tendency to focus on the part of strategy that is relevant to them. At the same time, competition for resources arises. This

also creates barriers to the flow of information and, as a consequence, functional differentiations appear.

## 4.    IT and the Organizations

Information Technology (IT) is defined as "the technology for gathering, handling, processing, storing and accessing data" (Hoogervorst, 2009, p. 189). IT includes networks as well.

Organizations made use of IT to ease restructuring, modernization and governance efforts (Tarabanis, Peristeras, & Fragidis, 2001, p. 988). IT was also incorporated to be a business differentiator in the competitive environment. Technology became part of almost every job and task and was used to support preexisting processes. Most of those jobs and tasks turn out to be IT reliant, heavily dependent on and enabled by IT, if not fully automated (Op't Land et al., 2009, p. 9).

The relation between IT and organizations is a complex one. Raymond (2010, p. 24) presented the dominant theoretical perspectives of this relation spanning the last 50 years. In the 1960s, a deterministic theory was adopted in which "IT was treated in the same way as production technologies, as an external force producing predictable and inevitable impacts on organizations and their members." These theories evolved to describe additional observed outcomes. In the 2000s, the dominant theoretical perspective developed was a human agency research perspective, which put human agency and voluntarism as essential concepts, stipulating that "humans can exert some power and free will to influence the design, interpretation and use of technology and their environment to achieve their interests and goals" (Raymond, 2010, p. 31). IT went from the concept of a tool with a defined and fixed result to a concept in which the impact depended upon its use, a concept in which information systems and organizations influence each other.

IT acquisition and implementation happened over a brief period. Because it was hard to track, IT was assumed to be a specialist business. IT was just a tool that automated certain processes. Management could not fully understand the effects it could bring. Some of these effects are the dilution of time and space boundaries; enterprise

integration, coordination and collaboration; and changes in the relationships of the enterprise with customers and with other enterprises. One of the most important impacts IT produced is described by Hoogervorst (2009, p. 196): "IT is seen as a technology that might change the relationship fundamentally between enterprises and their customers, since IT capabilities enable the argued necessary transition from a transaction-oriented relationship with customers towards a support-oriented relationship."

IT was not completely considered to be crucial and capable of bringing added value to the organization or even changing the way tasks are carried out (Cuenca, Ortiz & Boza, 2010, p. 24). In that sense, IT was adopted as a collection of single-function solutions that reduce the ability to secure information systems, obstruct the capacity to share information, and unnecessarily consume the finite resources available.

As a general conclusion, IT should be more than the simple acquisition of state of the art technology to implement solutions. It should be considered in the context of the organization, to use it to provide the described impacts that allow the integration, coordination and operational excellence of the enterprise (Ross et al., 2006, p. 4).

## B.    ENTERPRISE ARCHITECTURE

As was described previously, organizations face many challenges. One of them, the modern environment, is characterized by an information culture that is constantly producing instantaneous changes, without space and distance limitations. In the same way four layers were identified in organizations, four layers can be identified in this information environment. From the top to the bottom they are (Goolsby, 2015, p. 3): (1) information stakeholders, those who have strategic influence; (2) social level, the physical and social place where most of the interactions and dynamics occur, where behaviors, social innovations, and unexpected relations take place; (3) information technologies, the applications and software that are used in the physical platforms; and (4) physical technology, that is all the devices introduced by the industry.

The second layer, a socio-technical one, is where all the dynamics are created. The technological and social domains meet there. This is the layer of interest to every organization.

Two of the problems that organizations face, system complexity and poor business alignment, started to be addressed 20 years ago. As systems and organizations become more complex, more planning is required.

To deal with these dynamic elements, the classical approach of developing solutions from strategic initiatives through programmatic implementation is not the most adequate. Ross et al. (2006, p. 6) described the process that is usually used: strategy is defined, then supporting IT solutions are designed, and finally, the implementation through applications, data and technology is released. This logic starts again every time a new strategic goal is defined. Unfortunately, strategy is not always clear enough, making IT solutions hard to design and causing problems: every IT solution is developed in isolation and implemented on different technologies, and IT acts by reacting to the strategic initiatives, so it does not provide future capabilities. The resultant state can be seen in Figure 2.
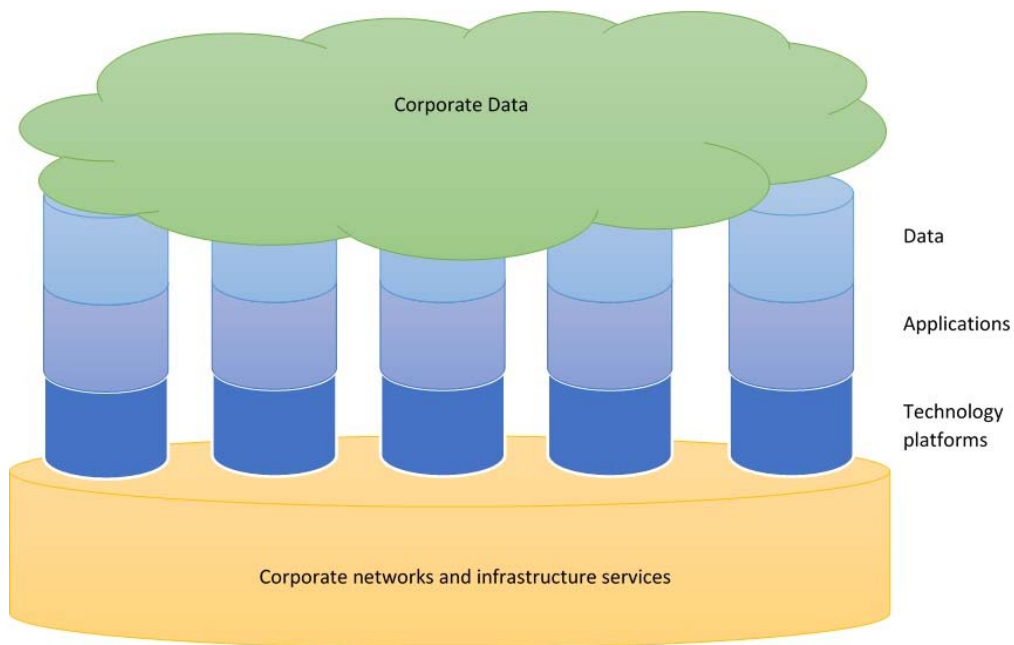


Figure 2.     Current Enterprise Architecture Status.
Source: Ross et al. (2006).

Capabilities are defined as "an enterprise's repeatable patterns of action in the application of knowledge to the use of resources in pursuit of its goals that enable it to perform optimally in activities that typically require processes, people, and technology" (Wolf Management Consultants, 2015). Organizations need to develop capabilities because they "represent the collective abilities of the organization to accomplish strategic objectives; it's the know-how that enables an organization to perform; the unique skills and processes needed to congruently fill the gap between intention and outcome" (Wolf Management Consultants, 2015). Capabilities must not be confused with business processes.

The pathway from strategy to action needs a supporting instrument. It is necessary to make strategy less ambiguous in order to provide the desired future state. Programs and projects that aim for that desired state need to be designed. At the same time, it is necessary to assess the impact of the change on the current state (Op't Land et al., 2009, p. 21).

"A method to structure and document these alternatives is necessary, just as tracing of the contributions of individual proposed projects to the realization of the strategy" (Op't Land et al., 2009, p. 21). These problems were identified by J. A. Zachman in 1987. Sessions (2007, p. 6) described how Zachman published an article in the IBM System Journal titled "A Framework for Information Systems Architecture." In that paper, Zachman outlined the basis of this instrument that could be obtained by a "holistic approach" (Sessions, 2007, p. 6); this is the first reference to systems architecture. This approach "explicitly looked at every important issue from every important perspective" (Sessions, 2007, p. 6). This "multi-perspective approach to architecting systems" was "renamed to be an enterprise architecture framework" (Sessions, 2007, p. 6).

The concept of architecture was taken from the construction industry. It was introduced first in the information systems world and later in the enterprise organizations. As structures increase in complexity, it is necessary to obtain insight into the relationships that are established to erect them and plan them before starting to build them.

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As the IT industry realized that software applications and solutions became larger and more complex, the term architecture was adopted from the construction industry. In his paper, Zachman said that "the cost involved and the success of the business depending increasingly on its information systems require a disciplined approach to the management of those systems" (Zachman, 1987, p. 276).

Op't Land et al. stated that it was noticed that the development of IT needed "to be done in concurrence with the development of the context in which was used." This led "to the business/IT alignment problem" (Op't Land et al., 2009, p. 26). Later, it was perceived that this alignment was not enough, as many more aspects needed alignment, leading to the use of the concept of architecture at the enterprise level (Op't Land et al., 2009, p. 27). The elements previously identified in every organization—the strategic, the business and operations process, the applications and data, and the network and technology levels—needed to be seen in an holistic and integrated view, where planning is driven by the strategic goals and business requirements, considering the organization's current and future state.

IEEE-1471–2000 defined architecture as "the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution." Op't Land et al. explained that Enterprise Architecture is developed from two main concepts. The first is the definition of architecture as an allusion to structure and relationships. The second is the definition of enterprise as an organization that needs a "set of governing principles that provide guidance and support for directions and decisions" (Op't Land et al., 2009, p. 33). From the relationship and combination of these two definitions, the Enterprise Architecture concept is obtained (Op't Land et al., 2009, pp. 33–34). Bredemeyer, Malan, Krishnan, and Lafrenz (2003, p. 5) described how "Enterprise architecture provides a common basis for understanding and communicating how systems are structured to meet strategic objectives. It is the road to the desired state that enables integrated business intelligence, connects strategy to execution, and enables flexibility and adaptability so that business capabilities can keep pace with changes in strategy." Bredemeyer et al. also explained that its purpose is to "provide a balanced approach to the selection, design,

development and deployment of all the solutions to support the enterprise; to allow stakeholders to prioritize and justify conflicting technology trade-off decisions based on the big picture; and to lead to consolidation and simplification, to more disciplined approaches to system planning, funding and development and to better risk management" (Bredemeyer, Malan, Krishnan, & Lafrenz, 2003, p. 5).

Currently there are many enterprise architectural methodologies that were developed during the last two decades. The most-used methodologies, according to author R. Sessions, are the following:

- The Zachman Framework for Enterprise Architectures

- The Open Group Architectural Framework (TOGAF)

- The Federal Enterprise Architecture

- The Gartner Methodology (Sessions, 2007, p. 1)

All of these methodologies are sometimes considered as Enterprise Architecture frameworks, although it is better to consider them as methodological approaches to Enterprise Architecture with their own particular characteristics.

### 1.    Zachman Framework

The Zachman Framework for Enterprise Architecture is defined by its author as an ontology. It consists of a schema that "yields the total set of descriptive representations relevant for describing an enterprise" (Zachman, 2008, p. 3). The framework has two dimensions. The first one consists of a number of scopes or foci, each considered from the second dimension given by the stakeholders' perspectives. The intersection of both dimensions is the enterprise artifact. Every stakeholder has a different interest and demands different information from every artifact. Zachman proposed that there are six stakeholder perspectives in an enterprise—planner, owner, designer, builder, technician, and enterprise or users—and six descriptive foci—inventory, process, distribution, responsibility, time, and motivation. These relations are arranged in a grid that takes the form of a six-by-six matrix, as in Figure 3.

Figure 3.    The Zachman Framework for Enterprise Architecture.
Source: Zachman (2008).

Sessions (2007, p. 13) gave a description of the matrix. In this matrix, every artifact must be placed in a single cell; this ensures that every artifact is properly defined and there are no ambiguities. If an artifact cannot be placed, then there is a problem with the artifact itself. The matrix is complete when every cell has an artifact; this makes sure that every stakeholder has a well-defined scope within the enterprise. Cells in every column must be related to the others; this means that for the same foci, there are different perspectives. The Zachman Framework is not a process; it is an ontological structure that describes an enterprise, providing predictable and repeatable results (Zachman, 2008). In this sense, it can be used as the starting point to develop an architecture.

## 2.    Open Group Architectural Framework (TOGAF)

The Open Group Architectural Framework (TOGAF) is defined as a framework for developing an enterprise architecture. The Open Group website (2016) described how "The original development of TOGAF was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the U.S. Department of Defense (DoD). The DoD gave The Open Group explicit permission and encouragement to create TOGAF by building on the TAFIM, which itself was the result of many years of development effort and many millions of dollars of U.S. Government investment" (The Open Group, 2016).

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TOGAF aims to improve business efficiency. It aims to help avoid the use of proprietary methodologies, make a more effective and efficient use of resources and get greater returns or outcomes (Josey, 2009, p. 5). TOGAF clearly defines enterprise and extends it to provide an enterprise architecture definition and description. According to the TOGAF website (The Open Group, 2016), the architecture of an enterprise is divided into four categories of types:

- Business Architecture: the business strategy, governance, organization, and key business processes

- Data Architecture: the structure of an organization's logical and physical data assets and data management resources

- Application architecture: a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization

- Technology Architecture: the logical software and hardware capabilities that are required to support the deployment of business, data, and application services. This includes IT infrastructure, middleware, networks, communications, processing, and standards. (The Open Group, 2016)

The TOGAF standard is divided into seven parts, with the second part being the core of the framework. It describes the Architecture Development Method (ADM) that is a step-by-step guide to develop an enterprise architecture (Josey, 2009, p. 7). Around it, each of the other parts develops the architectural process, producing information and support among them. "The structure of the TOGAF documentation reflects the structure and content of an Architecture Capability within an enterprise" (The Open Group, 2016), as shown in Figure 4.
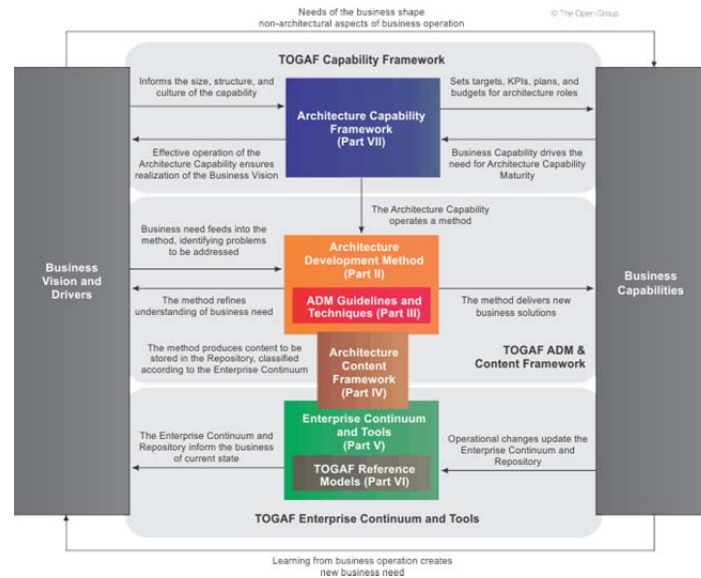
Figure 4.     The Structure of the TOGAF Document.
Source: The Open Group (2016).

An important characteristic of the TOGAF model of an enterprise architecture consists of a range of architectures defined as the Enterprise Continuum. Sessions described how "TOGAF views the world of enterprise architecture as a continuum of architectures, ranging from highly generic to highly specific" (Sessions, 2007, p. 16). The pathway from generic to specific is provided by the ADM process (The Open Group, 2016).

### 3.     Federal Enterprise Architecture

The FEA Consolidated Reference Model described how the "Federal Enterprise Architecture (FEA) consists of a set of interrelated reference models designed to facilitate cross-agency analysis and the identification of duplicative artifacts within and across agencies" (Executive Office of the President of the United States, 2007, p. 5). One of its goals is to better manage and leverage IT across the federal government. According to this document, the five FEA reference models are:

- Performance Reference Model

- Business Reference Model

- Service Component Reference Model

- Technical Reference Model

- Data Reference Model (Executive Office of the President of the United States, 2007, p. 5)

According to Sessions, "the Federal Enterprise Architecture (FEA) is the latest attempt by the federal government to unite its myriad of agencies and functions under a single common and ubiquitous enterprise architecture" (Sessions, 2007, p. 22). The author explained that FEA has both a taxonomy and an architectural process. FEA can be seen "either as a methodology for creating an enterprise architecture or the result of applying that process to a particular enterprise" (Sessions, 2007, p. 22). The author described how FEA methodology includes all of the following characteristics:

- A perspective on how enterprise architectures should be viewed (the segment model)

- A set of reference models for describing different perspectives of the enterprise architecture (the five reference models)

- A process for creating an enterprise architecture

- A transitional process

- A taxonomy for cataloging assets

- An approach to measuring the success of using the enterprise architecture (Sessions, 2007, p. 22)

Sessions explained the segment model. The author first clarified that "the FEA perspective on enterprise architecture is that an enterprise is built of segments. A segment is a major line-of-business functionality, such as human resources" (Sessions, 2007, p. 23). The author then identified the two types of segments as core mission area segments and business services segments (Sessions, 2007, p. 23). Then, he described segments.

> A core mission area segment is one that is central to the mission or purpose of a particular agency boundary within the enterprise. A business services segment is one that is foundational to most public agencies organizations. Another type of enterprise architecture asset is an enterprise service. An enterprise service is a well-defined function that spans boundaries. The difference is that business service segments have a scope that encompass[es] only a single organization. Enterprise services have a scope that encompass[es] the entire enterprise. (Sessions, 2007, p. 23)

This model is illustrated in Figure 5.
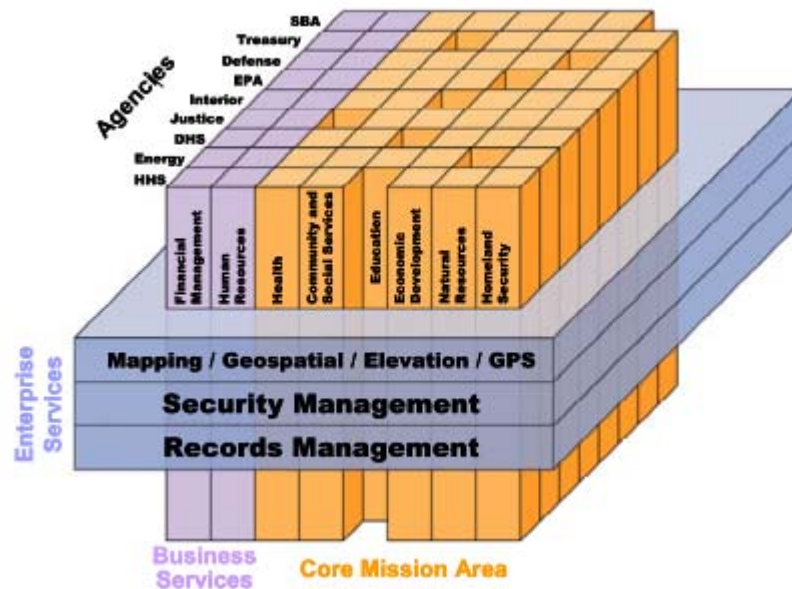


Figure 5.    Segments and Services. Source: Federal Enterprise Architecture
Program Management Office (2007).

Sessions finished describing the FEA Process by saying that it "is primarily focused on creating a segment architecture for a subset of the overall enterprise" (Sessions, 2007, p. 26). The author then provided the steps of the process:

- Architectural Analysis: define a simple and concise vision for the segment and relate it back to the organizational plan

- Architectural Definition: define the desired architectural state of the segment, document the performance goals, consider design alternatives and develop an enterprise architecture for the segment including business, data, services, and technology architectures

- Investment and Funding Strategy: consider how the project will be funded

- Program Management Plan and Execute Projects: create a plan for managing and executing the project, including milestones and performance measures that will assess project success (Sessions, 2007, p. 26)

FEA is an attempt to develop a methodology that includes everything that is necessary to build a particular enterprise architecture for the U.S. Government.

### 4. Gartner Methodology

The Gartner Methodology can be termed as an enterprise architectural practice, in order to differentiate it from a taxonomy (Zachman, 2008), a process (TOGAF) or a methodology (FEA). The methodology is based on putting together three important components of an enterprise: the business owners, the information specialist and the technology implementers (Sessions, 2007, p. 30). The goal is to align them with a common vision. The methodology aims to start from the desired "to-be" instead of the current "as-is." There are no standard documents or reports. The aim is to have a shared vision that will drive the implications at every level of the organization. As Sessions (2007, p. 30) stated, "The two things that are most important to Gartner are where an organization is going and how it will get there." Any activity that is not related to this statement is considered irrelevant.

Enterprise Architecture is not a simple and easy task. The methodologies described provide an explanation of how complex these practices could be. Results are neither immediate nor simply evident, but they provide an organization's long-term view, identifying processes, data, technologies and customer interfaces to replace individual solutions with capabilities (Ross et al., 2006, p. 9). As Op't Land et al. explained "It can help organizations and their transformation processes in successfully executing their strategy," acting "as an active planning and steering instrument" (Op't Land et al., 2009, p. 35).

Having the right architecture allows an organization to define and develop its core capabilities. Organizations go through four maturity stages in procuring new organizational processes and changing their IT practices and culture. Ross et al. described how "each stage encompasses organizational learning about how to apply IT and business process discipline as capabilities" (Ross et al., 2006, p. 71). These four stages of architecture maturity developed by Ross et al. are:

- Business Silos

- Standardized Technology

- Optimized Core

- Business Modularity (Ross et al., 2006, p. 71)

Ross et al. explained that in the Business Silos stage IT is focused on providing solutions to local components of the organizations. These components just take advantage of local opportunities by solving their own particular needs through technology. The first goal is to reduce costs. The first step is to model the processes that take place in these particular environments. After these model are obtained, the necessary technology and applications are developed or bought to satisfy the requirements. These ad-hoc solutions have the advantage of providing local improvements. The disadvantage is that after a time, as result, a myriad of legacy systems live together unable to communicate with each other. The integration and interoperability of these systems is complex and expensive. As a result, the overall system gets complex and integration and standardization are blocked (Ross et al., 2006, pp. 72–74).

To overcome the drawbacks of the previous stage, Ross et al. described how organizations move to the following stage, Standardized Technology. In this stage, an organization attempts to introduce more IT efficiency. To achieve this capability, the goal is to move from local IT applications to a shared infrastructure. During this stage, technology standards are introduced. Technology standardization reduces costs and risks and data can be shared across the infrastructure, but still the information is linked to individual applications (Ross et al., 2006, pp 74–76).

The next logical stage is to share data across the entire organization, reducing redundancy and making the data available to the appropriate processes and stakeholders. These are the goals of the Optimized Core stage. As Ross et al. (2006, p. 76) described, "In this stage, companies are also developing interfaces to critical corporate data and, if appropriate, standardizing business processes and IT applications." At this stage, there is a great effort to digitize data and business processes that could make it difficult to introduce changes later. The advantage is that as the core data and processes have been

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digitized and automated, the desired outcomes are more easily achieved because managers can focus on opportunities (Ross et al., 2006, p. 77).

Business Modularity is the last possible stage. At this point, the organization achieves its ultimate desired capability, strategic agility (Ross et al., 2006, p. 77). This is done by modularizing the digitized processes and data on the previous stage. Business Modularity consists of a kind of plug-and-play business processes modules that can be arranged as necessary to increase the time response to opportunities that may appear.

## C.   FOUNDATION FOR EXECUTION

Although strategy provides the long-term view of an organization, survival and competitive advantage are based on how activities are performed. In this way, routine jobs need to be automated and performed reliably and predictably so governance can focus on higher-level scopes. Three disciplines are needed to achieve this capability:

### 1.   Enterprise Architecture

There is no one way of creating enterprise architecture, but most organizations have developed one to achieve their goals and survive. Although these organizations have not embraced one of the formal methodologies described, as Ross et al. explained, they do need a set of principles and rules to guide their activities and processes. It is imperative for the organizations to "design the processes and infrastructure critical to their current and future operations" (Ross et al., 2006, p. viii). This can be facilitated by adopting one of the methodologies described.

### 2.   Operating Model

Having set an Enterprise Architecture, organizations have to define an operating model. This operating model defines how an organization will execute its business. An operating model is defined by Ross et al. as "the necessary level of business process integration and standardization" (Ross et al., 2006, p. 8) that enables the implementation of the strategic initiatives. It supports strategic initiatives by highlighting the desired capabilities.

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Every operating model is a function of two components, standardization and integration. Standardization expresses how processes will be carried out. It is independent of who will perform the activity in order to ensure that it will always will be done in the same way. In this sense, predictability and efficiency are gained. Integration implies shared data between or across processes. Shared data brings great implications because its format must be collectively settled.

Combining the two components, a two-dimensional model with four levels is obtained. In this model, four types of operating model are defined: diversification, coordination, replication and unification. Their main characteristics are displayed in Table 1.

An organization can have only one model at the highest level, but may have several in the lower levels. It is important to know in which model the organization is located and which model it wants to adopt.

Table 1.   Operating Models. Adapted from Ross et al. (2006).

| Model | Dimensions | Characteristics | IT Capability | Standardization Requirements |
|---|---|---|---|---|
| Diversification | Low standardization and low integration | Independent business units with different customers and expertise | Provides economies of scale without limiting independence | Shared services<br><br>Infrastructure technology |
| Coordination | Low standardization and high integration | Unique business units with a need to know each other's transactions | Access to shared data through standard technology interfaces | Customer and product data<br><br>Shared services<br><br>Infrastructure, portal, and middleware technology |
| Replication | High standardization and low integration | Independent but similar business units | Provides standard infrastructure and application components for global efficiencies | Operational processes<br><br>Shared services<br><br>Infrastructure technology and application systems |
| Unification | High standardization and high integration | Single business with global process standards and global data access | Enterprise systems reinforcing standard processes and providing global data access | Operational and decision-making processes<br><br>Customer and product data<br><br>Shared services<br><br>Infrastructure technology and application systems |

## 3.    Engagement Model

The IT engagement model is defined as "the system of governance mechanisms assuring that business and IT projects achieve both local and company-wide objectives"

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(Ross et al., 2006, p. 9). Its aim is to provide linking mechanisms that coordinate and align the highest and lower decision levels, from the company level, through the business unit, to the project team level.

The engagement model delivers coordination by means of these linking mechanisms, making available goals and priorities to all the organization's stakeholders; it also provides alignment between IT and business activities. In this way, all the differences are solved considering the organization's top goals.

With these three disciplines—the operating model, enterprise architecture and IT engagement model—an organization can build and leverage an effective foundation for execution, defined by Ross et al. as "the IT infrastructure and digitized business processes automating a company's core capabilities" (Ross et al., 2006, p. 4). The foundation for execution digitizes the fundamental mundane practices that must go right to provide reliability and predictability. It was mentioned that a fast-changing environment is one of the challenges an organization has to face. How the environment will change, or what changes an organization will have to perform, is hard to assess. If a good foundation for execution is achieved, however, digitizing routine and permanent activities, the organization can dedicate their management resources and capabilities to assessing future and sudden changes and act accordingly. In this way, agility is obtained.

Ross et al. stated that, in order "to create and exploit the foundation for execution" (Ross et al., 2006. p. 10), the operating model defines the vision of how the company will operate, and the integration and standardization requirements. Based on this vision, business and IT leaders define the enterprise architecture that provides limits to the strategic level and core capabilities for the engagement model. The strategic level generates prioritized strategic initiatives that are submitted to the IT engagement model. Then, the author explained, this level can specify "how each project benefits from and contributes to the foundation for execution" (Ross et al., 2006, p, 10). By learning and exploitation, business initiatives can be reformulated.

After a model has been selected and set, the following outcomes can be expected to happen (Ross et al., 2006):

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- Organizations mature enterprise architecture gradually and build out their platforms.

- Architecture maturity increases global agility.

- IT spending changes as architecture matures.

- Enterprise architecture benefits by stages.

- Architecture maturity is a learning process.

- Organizations learn by building management competencies.

- Organizations build competencies in stages.

- The best organizations set themselves apart from their competitors by increasing their involvement of senior managers with enterprise architecture, integration of architecture with project methodology, and enterprise architecture maturity (Ross et al., 2006, p. 110).

- The CIO role evolves as the organization's architecture matures.

- Roles and responsibilities change as organizations transition from transformation to driving value from a digitized platform.

## D.    PUBLIC ADMINISTRATION ORGANIZATIONS

Military organizations in Argentina are considered Public Administration (PA) Organizations. Although they have a defined scope and are different from other public organizations regarding their activities, they have to adhere to public legislation when considering several administrative tasks. At the same time, many characteristics of public administration can be identified.

It was described before that public enterprises are exposed to the same challenges and pitfalls as private enterprises, although there are some differences. The environment is the same but the users (identified as the citizens) add another type of pressure that is different from profit. Public opinion claims for some characteristics of public administration should provide the following (Tarabanis et al., 2001, p. 988):

- Public service in a client-focus approach

- Performance and quality

- Budget optimization

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- IT-enabled services

Tarabanis et al. (2001, p. 988) described how Public Administration Organizations have also been put under pressure to insert themselves into the globalized environment and compete as modern enterprises. Some of the most important pitfalls they have to overcome are:

- Administrative procedures can be highly complex, where many actors exercise some type of authority by means of a large bureaucracy. The following negative specific characteristics are present:

- Low-quality internal communication with many units hardly interconnected, known as legacy systems

- Many definitions and terminology in use

- High-level goals not clearly defined or known and, consequently, processes not completely defined by human roles not well understood

PA organizations use the same classical methodology as described previously—strategic formulation and implementation—to provide services, performing many kind of operations. Tarabanis (2001, p. 990) proposed a model on how a PA organization works: social needs drive the formulation of public policies that could be linked to the strategy formulation. This strategy formulation is formulated outside or inside the organization. Then, the strategy formulation has to be put into effect by means of a strategy implementation. This strategy process is influenced by some external factors that comprise several aspects (Tarabanis, 2001, p. 992):

- Culture: includes the values, vision and power structure

- Environment: given by the government, the political system, other PA organizations, the needs of society, technology and many others

- Knowledge: includes strategic information, core competencies and others

- Resources: includes financial, human, technological, etc.

- Organization: structure, roles, etc.

- Function: given by tasks, activities, processes and so on

PA organizations have to provide services to society according to the strategy formulated by the political power. This manifests as public policies by means of a

strategy implementation that takes the form of programs and projects supported by different types of operations.

The service that military organizations provide is the defense of the national interests and its population. Service also includes other support activities that take the form of missions that the political authorities order to satisfy certain social needs.

PA and military organizations include the levels identified in every organization: strategic, business and operations process, applications and data, and network and technology levels. In this sense, the Enterprise Architecture methodology can be implemented to achieve the strategy formulated. As every organization has a myriad of repetitive and routine tasks, the actual architecture could be employed, first identifying it by a taxonomy methodology and later implementing a foundation for execution to excel in their tasks and activities. In this way, as described, strategic managers can focus on high-level scopes.

## E.    SUMMARY

The definition of an enterprise was introduced. Goals and challenges are inherent to their existence. In order to achieve those goals and face challenges successfully, enterprises made use of a classical methodology to survive and thrive: strategy, programs plans and policies take the organization into action. In the last 20 years, technology was incorporated to be a business differentiator in an increasingly competitive environment. It became part of almost every job and task and was used to support preexisting processes. At the same time, technology created an information environment. These elements—the organizational components, technology and information environment—highlighted the need for a new instrument that could provide a blueprint of the organization from a holistic point of view. This instrument was named Enterprise Architecture and it became fundamental to solve the business/IT alignment problem. Four methodologies were described: The Zachman Framework for Enterprise Architectures, The Open Group Architectural Framework (TOGAF), The Federal Enterprise Architecture and the Gartner Methodology. The development of an Enterprise Architecture goes through four maturity

stages that were described: Business Silos, Standardized Technology, Optimized Core and Business Modularity.

Another methodology—Foundation for Execution—was introduced. In order to adopt this methodology, an organization needs to develop three key disciplines: an Enterprise Architecture, an Operating model and an Engagement model.

Public Administration Organizations were described. These organization have the same characteristics as private organizations, although the new organizational practices are put into practice later. Because of the new information environment created by technology, Public Agencies are under pressure to adopt modern methodologies. The Argentinian Army is considered to be a Public Agency, putting aside its particular goal. It has all the components that were described for any organization and it has to operate in the same information environment. Its mission can be considered as a service that it must provide to the country and society. It is necessary to describe and assess the organization in order to adopt and implement a methodology that can incorporate new and modern organizational practices. In this way, it will provide the best service to the country.

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# III. THE ARGENTINIAN ARMY

## A. NATIONAL DEFENSE SYSTEM

The current legal and administrative issues for Argentina's National Defense are based on the principles of the Argentinian Constitution and a set of laws and international treaties incorporated in the 1994 reforms, whose centerpiece is the National Defense Act of 1988. The new Defense Law was gradually complemented by the law of Homeland Security of 1992, the law of Voluntary Military Service of 1994, the Armed Forces Restructuring of 1998, the National Intelligence Law of 2001 and the Military Justice System Reform of 2008. Additionally, a whole set of concepts aimed at establishing specific guidelines for management decision making, determining precise competencies and responsibilities for the different stakeholders that compose the Defense System, was enacted.

The National Defense System is structurally and functionally organized to determine and support the National Defense Policy, whose scope is to avert military attacks by other states.

One aspect of fundamental importance established by the Law of Defense is the distinction in the armed forces between administrative and operational functions. The armed forces constitute the entities that must manage the means that they are provided with on one side, and on the other side they must prepare for war using those elements and provide the logistics support if they are deployed.

The elements of the armed forces are liable to be assigned as components of joint operational strategic commands. Under the Defense Act, none of the armed forces branches can perform operational activities on its own initiative. This is a function reserved to the President of the Nation, the Minister of Defense and the Operational Commands that are established.

The three armed forces—Army, Navy and Air Force—are engaged during peacetime in achieving readiness, training, and making themselves available to the Joint Staff Operational Command (which is responsible for conducting ongoing operations).

During wartime, the forces subordinate themselves to the Operational Commands determined by the President's Office.

The material and human resources of the armed forces are determined by the design of a military instrument defined in the military strategic planning.

The armed forces branches have similar upper-level organization, led in each case by the respective Chief of the General Staff. The organization includes a support structure that depends of the Deputy Chief of General Staff as well as a Readiness and Training Command to which the operating units are subordinated. These commands have the task of planning and conducting the readiness and training of the operational resources and eventually supporting society according to what is determined by the joint military planning.

The support structure that is common to all the three forces comprises the areas of organization and doctrine, research and development, materials, intelligence, education, health, personnel and welfare, and communications and information technology.

## B.     MISSION, VISION AND ORGANIZATION OF THE ARMY

The Argentinian Army is one of the oldest and largest institutions in Argentina. It has about 50,000 active duty military personnel, plus the reserves, civilian employees, the retired, and the families. It is deployed throughout Argentina's 1.08 million square miles; detachments also serve in Antarctica and two foreign countries as part of UN missions. It also has some military observers in different missions, military attachés, students in many countries and others.

As with every organization, the Army has a vision, a mission, and goals; it also issues policies that guide its action (Ejercito Argentino, 2016). These are available on the Army's website, stated as follows:

Mission–The Army will serve the country, contributing to the national defense to protect its vital interests: the independence and sovereignty, the ability to self-determination, the territorial integrity, the natural resources, the protection of property, and the life and freedom of its inhabitants.

Vision–Achieve a modern army supported by the values set by General San Martin and democratic and republican values; the Army will be enlisted, trained and equipped to defend the vital interests of the nation; The Army will be integrated with the Armed Forces of the country and the region, committed to national development and the solidarity and support of all Argentinian citizens.

The main goal is to achieve an operational, efficient and effective army that can act when required to defend the interests of the nation, and to contribute to the technological, economic and social development and the general welfare of the inhabitants. From this main goal, many other dependent goals are established, as well as the policies to get them.

The main characteristic of the new organization of the army is the distinction between administrative and operational functions. This distinction can be viewed in Figure 6, where the two broad areas can be differentiated.
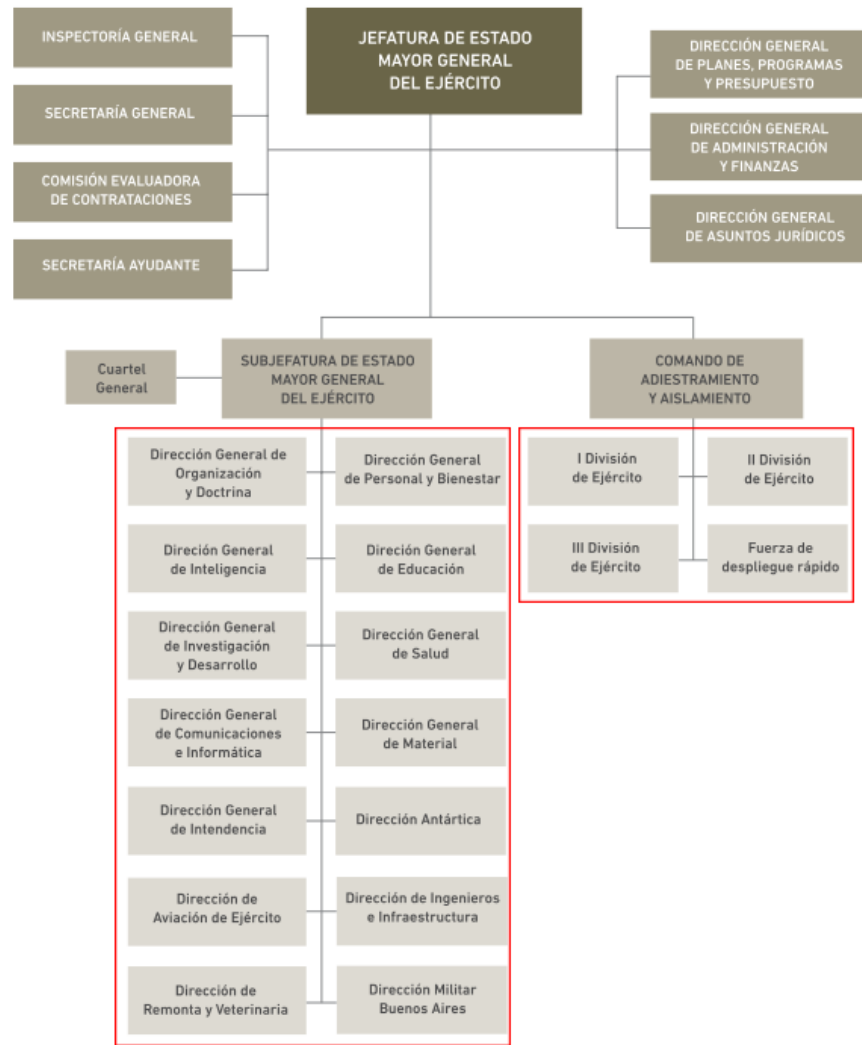
Figure 6.    The Current Structure of the Argentinian Army.
Source: Libro Blanco de la Defensa (2015)

All these areas and organizations made of resources and activities produce large amounts of data as a result of their interactions and processes. Consequently, every level in the chain of command has always generated and needed timely, accurate, and focused information. This information is used to make decisions and take action so every organization can perform the inherent activities and accomplish the assigned missions. These processes need to be modeled and defined as a system. System analysis enables the Army to understand and specify what a system should achieve.

## C.     DATA AND INFORMATION

Networks and information generation on a big scale are not new (Atkinson & Moffat, 2005, p. 2). They have always existed. "Complexity, forms, patterns, and shapes that emerge from an organizational structure, provide meaning and understanding to the many interlinked and connected activities" (Atkinson & Moffat, 2005, p. 2). As with every organization, the Army incorporated the use of IT to process information. The amount of equipment and networks in use increased significantly over the past 20 years. Although IT proved to be a valuable resource, an information environment culture has not yet been created. Nevertheless, IT is in use. Some applications were developed to improve centralized processes and many ad-hoc solutions were applied. All of that resulted in numerous systems that are difficult to integrate and are not as effective as needed. Currently, IT looks like little more than a collection of single-function solutions (Argillander, 2012, p. 5) with some efforts to produce organizational centralized solutions. Some of them are related to the areas of personnel, logistics, finances and project management. This corresponds to a silo stage in the architectural maturity model.

From Figure 3, it can be inferred that the area that performs administrative functions to support the activities of the operational area will need to exchange data and produce information using applications and technology. Both areas can be seen as a provider and customer relationship or as a server-client one.

The Army needs to reinforce the value of information and consider it as an asset to all stakeholders. A clear distinction between information and data must be made. Information is derived from data provided by users through processing and then "is placed in context, related to other data or previous information" (Cramer, 1997, p. 2). It is not straightforward inference (Cramer, 1997, p. 2). The context in which information is derived from data in the Army comes mainly from two possible sources. These sources are the operational basis (i.e., the information required to develop business processes) and the collection basis (i.e., information collected per se, in which the value may be added later).

The value that information provides depends on the user context. In the case of the administrative area, IT needs information to provide support to the operational area. Information in this context could be assigned a financial value. Timely information can save money, as the administrative area can optimize the use of the available budget to acquire and provide what the operational area needs, when it needs it, and before those needs increase in cost.

Information is part of daily operations. It is present in numerous assorted arrangements such as management, command and guidance, operational processes, technical databases, equipment and weapons technical data, staff knowledge and others.

Information has to be put in a structure, in a model that shows all the roles that it performs in the organization's business processes of every component, and the leverage it provides. This is useful to reinforce the notion that information is an asset, by understanding the value it provides. Cramer delivered a model in which information assets are integrated into the organization's business units, processes and stakeholders, in different ways, resulting in several information resources that have a value and a risk.

> The model begins with a mission or vision statement, which communicates the purpose of the organization to its staff, customers, or the public. Managers use this statement within a planning process to develop plans including strategic or implementation plans. These plans control the use of available resources and processes to organize and direct them toward objectives. The individual processes utilize technologies and facilities. They are operated by knowledgeable staff and are supported by the organization's data bases. (Cramer, 1997, p. 6)

Cramer continued describing the model by describing the information assets that can be identified and the leverage they can provide:

- The mission statement drives the organization, directing the staff, processes, plans, databases and use of resources.

- Planning information drives staff, processes, data and resources.

- Process information is the technology in use throughout the organization's business processes.

- Database information is the required collection of information organized to be easily accessed, managed, and updated by many processes to function.

- Staff knowledge is the information that the organization's members have through education, training and experience, affecting the ability to plan and execute the processes.

For the administrative area, the value of information could be measured. The goal of this area is to support the operational area. If information is considered as an asset and could be aligned within the organization, it would reduce costs of many activities. This could be reflected in a reduction of the budget assigned to these activities.

## D.     ORGANIZATIONAL COMPONENTS

The organizational chart of the Army shows how the organization arranges the areas of responsibility and the dependencies, but it is far from being a model of the system. It does not show which tasks are performed, which processes take place and the impact of information and technology. All these elements are contained in directives, orders, standard operational procedures, and a myriad of documents issued by a valid authority. It is necessary to count with a system model that provides a holistic view where all this information can be assessed. This will allow the Army to deal with changes and improve the organization. It will also allow new commanders to get a rapid notion of the system and provide their personal direction, their intent.

An organizational model is the first step to get a sense of what tasks an organization performs, what its architecture is, what the inputs are and what results it gets. Models are also used to generate hypotheses about problem causes that have been detected after some symptoms were identified, and to find action steps to implement. Outputs are connected to inputs by means of feedback to refine the process. The model allows for an understanding of the dynamics and performance of the organization. Having this holistic view, a real change can be later introduced, the architecture can be modified by one of the methodologies mentioned before, or a foundation for execution can be implemented to improve business execution.

A system model describes the system's inputs, the throughput and the results. The inputs come from the environment and context, the key factors that describe what it takes to be successful and the system direction.

A useful tool is the Congruence Model (Nadler & Tushman, 2003), shown in Figure 7. In this model, the throughput is given from the inputs to the outputs through strategy by four main constituents: the work, the formal organization, the informal organization and the people. The work are the tasks and jobs; people are the ones who are responsible for the work and execute it; the formal organization is the "arrangements that provide structure and direction to their work" (Nadler & Tushman, 2003, p. 6); the informal organization is the "culture or operating environment, that reflects their values, beliefs and behavioral patterns" (Nadler & Tushman, 2003, p. 6). The degree of congruence among the components of the organization is assessed by evaluating their relations and interactions.



Figure 7.    The Congruence Model. Source: Nadler and Tushman (2003).

The model by Nadler and Tushman offers the following information: "provides a graphic representation of the organization as a social and technical system. The horizontal axis—the work and the formal organization—can be interpreted as the technical-structural dimension of the operating organization. The vertical axis—the people and the informal organization—constitutes the organization's social dimension" (Nadler & Tushman, 2003, p. 10).

This could be used to assess if IT and business fit (i.e., if they are aligned). If they are not aligned, it is possible to assess what is needed to align them and the impact that any change will have in the organization. In the particular case of the two areas that represent the support and the operational areas of the Army, both of them have to be interconnected, as they are. The mechanisms that provide the interconnection were established and are currently working. In this scenario, technology was not designed to be a capacity to link both areas as an inherent capacity. It acts more as a tool used in isolation.

## E.     IT INFRASTRUCTURE

Between 1971 and 1991, the Argentinian Army organized an element called Data Automatic Computing Systems Division (DISCAD) to introduce, implement, administer and manage the first computerized, centralized data systems. Because of the tendency towards increasingly decentralized, automated and faster systems and the introduction of increasingly complex applications, DISCAD was renamed the Department of Informatics in 1992, a name that remained until the end of 1993.

In 1994, all the existing organizations related to communications support and IT were merged into the Communications and Information Systems Directorate, in order to manage in an integrated view communications facilities and computer systems.

All the independent systems were merged, absorbed, disabled, replaced or upgraded, to be integrated in the current Unified Communications System (SUCOM). This system is made of different subsystems that provide voice and data facilities by processing, transporting and managing information.

The ongoing technological development made it necessary to expand the Directorate's incumbencies, so in 2004 it changed its name to Communications and Informatics Command. This organization continues to the present. It comprises the following departments: Communications, Informatics, Development and Software Development.

During the last decade, various solutions were implemented. One of the most important is that a systems integration digital network was made available. Networks were installed that included servers, Internet accessibility and an online education system, among others.

The Army has been directed to adopt a new organizational relationship among its components. Two broad elements can be distinguished, an administrative one and an operational one. All the four levels of an organization are present: the strategic, the business and operations process, the applications and data, and the network and technology.

All levels except the strategic level have to be re aligned to improve the overall efficacy and efficiency. Although old processes and business operations were adapted, new ones should be designed and established. This will introduce the need for new applications and the generation of data and new uses of networks and technology.

The current stage, in which an Enterprise Architecture methodology exists, is a good opportunity to design and implement architectural practices and methodologies and to align all the organizational components to get the best results and make the best use of the limited budget and resources.

## F.    SUMMARY

The Argentinian National Defense System has been described. The system determines how the organization and structure of the Armed Forces have to be developed. As with every organization, the Army has a mission, vision and strategy. It develops plans, programs and policies in order to achieve the goal and execute its inherent tasks. The main characteristic of the Army's structure is that it is separated into two great

sections, a supporting component and an operational component. These components can be viewed as having a provider-customer relation or a client-server relation.

Data and information in the Army were described, as was the evolution of the IT infrastructure. These elements have an important role in the organization, although the value of information as an asset needs to be reinforced.

The Congruence Model has been proposed to assess the organization and determine if processes and IT are aligned. Currently, there is an Enterprise Architecture methodology in use, although it does not resemble any formal methodology. This current state is a good opportunity to design and implement formal architectural practices and methodologies to align all the organizational components in order to achieve the goals and make the best use of the limited budget and resources.

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# IV. IMPLEMENTING AN EA IN THE ARGENTINIAN ARMY

## A. ASSESSING THE ORGANIZATION (THE AS-IS)

The Argentinian Army has a defined mission, vision and general and broad goals. Strategies and goals are set, as are the policies to achieve them through programs and projects. The road from strategy to execution needs a supporting instrument that provides, as Bernard described, "a holistic and integrated view of that strategic direction, the business practices, the information flow and the technology resources" (Bernard, 2012, p. 32). That instrument can be the adoption of a management and technology practice that aims to improve the overall performance.

As with every organization, the Army has to do the right things (effectiveness) and to do things right (efficiency). In that sense, the Army needs to have, as Bernard explained, "a high level, strategic view of the entire entity"—in this case, the organization—as well as a "structured framework for the analysis, planning and development of all resources" (Bernard, 2012. p. 32). Both the view and the framework will act as an authoritative reference for standards and practices (Bernard, 2012, p. 33). They can later be used for portfolio management, financial controls, application configuration and process transfer, communication, regulatory compliance and IT architecture design. In short, Enterprise Architecture is the tool needed to align, to standardize and to integrate the four structural levels of the organization.

The recent organization of the Army makes a clear distinction between administrative and operational functions. This distinction can be identified as the organizing logic for business processes (Ross et al., 2006, p. 9). The IT infrastructure and the integration and standardization requirements of the organization's operating model—the two main components according to Ross et al.—are yet to be introduced. In particular, information, technology and IT need to be viewed as strategic assets and made part of the organization's culture.

This thesis proposes to make use of the Zachman Framework and the Congruence Model to assess the current Army as-is, as it will be described.

## 1.    Framework

As with every organization, the Army has to deal with complexity. Complexity is present in the environment and the organization itself. When an organization performs its business processes, it gets complex. In this context, the organization performance needs to be measured and predicted. The starting point is to have a methodology to organize the many artifacts that an enterprise has, to have an organizational schema by which it can be assessed and developed. This can be done by the adoption of a framework. A framework can help to organize the models the organization has into several levels of abstraction. A framework can help to diagnose how the organizational strategies, the business processes and the resources are turned into a physical system.

The Zachman Framework (1996) for Enterprise Architecture can be defined as a taxonomy for organizing architectural artifacts. Sessions explained that it provides information of "who every artifact targets and what particular issue is being addressed" Sessions, 2007, p. 11). Zachman described his work by stating that his "framework as it applies to organizations is simply a logical structure for classifying and organizing the descriptive representations of an enterprise that are significant to the management of it, as well as to the development of the IT systems" (Zachman, 1996, p. 2). A framework is the starting point to gaining insight on an organization, but it is not enough. An organization needs process, methods, notation and tools for its future development (Bahill, Botta, & Daniels, 2006, p. 1).

Bahill et al. described the Zachman Framework as "a normalized six by six classification schema for organizing descriptive representations of an enterprise" (Bahill et al., 2006, p. 2). Zachman said that the framework "in its most simplistic form depicts the design artifacts that constitute the intersection between the perspectives represented in the design process" (Zachman, 1996) and the product abstractions. This is represented in Figure 8. Each cell in the schema has two dimensions: a scope (width) and level of detail (depth).

| | What | How | Where | Who | When | Why | |
|---|---|---|---|---|---|---|---|
| Planner | | | | | | | Scope |
| Owner | | | | | | | Concepts |
| Designer | | | | | | | Logic |
| Builder | | | | | | | Physics |
| Implementer | | | | | | | Technology |
| Operator | | | THE ENTERPRISE | | | | Product |
| | Material | Process | Geometry | Instructions | Timing | Objectives | |

Figure 8.    Generic Zachman Framework. Adapted from Zachman (2008).

Although the Army can be considered as a single organization, it has been structured in two differentiated areas, each one with different functions, goals, tasks and performances. This thesis proposes to apply the Zachman Framework to both areas, considering the interactions among them. The areas considered are the directorates that are part of the supporting element of the Army. The supporting element has to consider the operational area as a customer. The operational element has to consider the supporting element as a provider. In this way, as in Session's example, the framework can help in various ways:

- Ensure that every perspective has been considered for every descriptive focal point

- Improve the artifacts themselves by sharpening each of their focus points to one particular concern for one particular audience

- Ensure that all business requirements can be traced down to some technical implementation

- Ensure that every technical implementation has a useful functionality

- Ensure that the business commanders include IT solutions in their planning (Sessions, 2007, p. 15)

The Zachman Framework is not, by far, a complete solution, and it cannot be used to create an architecture. It provides a holistic understanding of the current architecture.

This view can then be used to produce a sense of dissatisfaction, a necessary condition to introduce change.

### 2. Organizational Model

Most of the changes in an organization occur during a time of crisis. When there is no crisis, people and organizations have a tendency to maintain the status quo. There are many cases in which an organization, even though it was having successful outcomes, went to a crisis because it was satisfied with the current performance. Crisis can be caused because the organization is not capable of anticipating changes in the environment and as a consequence does not adapt to new conditions. This lack of adaptation and change can lead to a catastrophic end. Public agencies are in a different condition; profit is not a major concern for them. Public agencies have to provide a service and be effective. Their existence is guaranteed by the state that created them. When resources are limited, efficiency is a major concern. Public agency managers seek to optimize the use of resources and provide the best service possible within the budget, making use of the material resources and personnel available.

As with any other public agency, the Army needs to optimize the use of its budget and personnel management. Most of its budget, more than three quarters of it, is used to pay salaries. The remaining quarter is used for maintenance, operations, research and development, and investments, as seen in Figure 9. In this sense, the administrative area has to be the most efficient it can be to use the resources in the most effective way. Personnel is another critical resource. In the last 33 years, personnel levels have decreased sharply. The figure went from 103,123 members in the year 1983 to 46,275 in the year 2014, as seen in Figure 10. Every Army soldier has to perform several tasks and is responsible for more than a single process or function. These two variables make it extremely necessary to automate the Army's core capabilities. If that can be achieved, the main effort can be focused on the new challenges that appear. Agility can be developed as well.
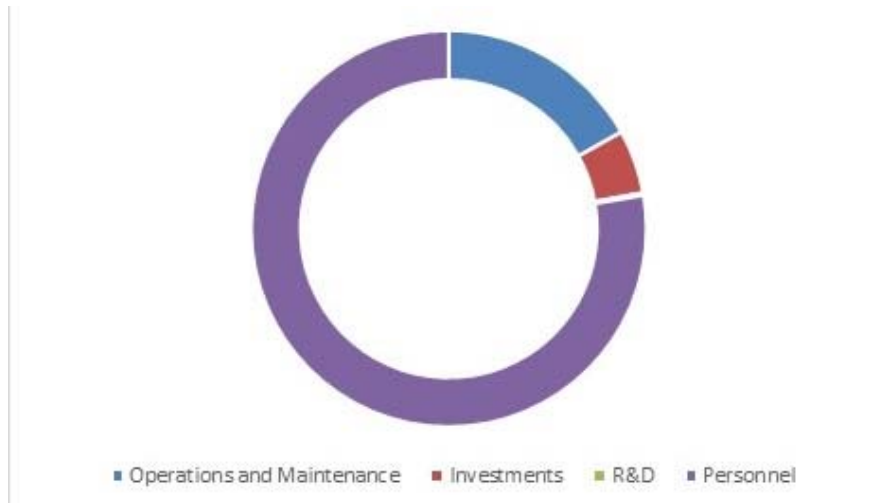
Figure 9.    Army Budget Distribution (Year 2014).
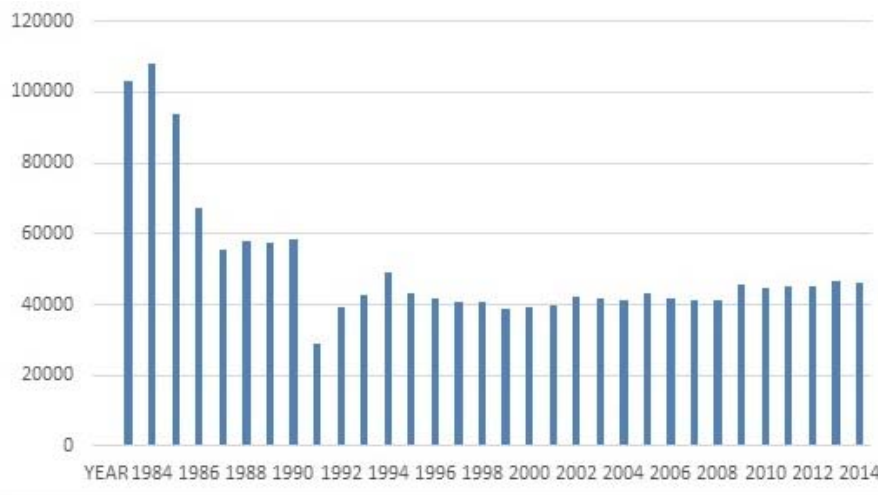Source: Libro Blanco de la Defensa (2015).



Figure 10.    Army's Personnel Evolution. Source: Libro Blanco
de la Defensa (2015).

Taking into account these two symptoms—scarce resources and reduction of personnel—the current system model can be developed. This thesis will use the Congruence Model. It provides a full description of the organization in a compact view. The Congruence Model evaluates how the organizational components fit (i.e., their congruence, how they are aligned). Alignment is one of the main scopes of Enterprise Architecture. A general description of the most significant features of this model will be described.

*a.*     *Inputs*

Inputs are classified in three main categories that affect the organization. They are the environment, the resources and the history. The environment imposes demands and constraints, and brings opportunities, to an organization. Resources include the whole range of assets, including capital, employees, technology and information. Technology and information are the ones that will be considered in more detail in this thesis. History includes the major stages of the organization, as well as the impact of several historical factors on the organization.

Technology and IT are part of an organization's resources that can provide capacities rather than solutions if they are part of the planning processes. In that sense, technology and IT should be considered as strategic assets instead of a liability. If we recall the Zachman Framework, not every business activity can be traced down to some technical implementation, nor does every technical implementation have a useful functionality. Currently, technology and IT are in use in the Army—but in isolation, rather than as complete solutions—and are seen more as a tool than an asset.

According to Higson and Waltho, "information is a key asset—perhaps the most valuable strategic asset an organization possess[es]" (Higson & Waltho, 2009, p. 1). If organizations focus on information instead of the technology, the authors explained that they can achieve "the full potential of their investments in IT and optimizing business performance" (Higson & Waltho, 2009, p. 1). Organizations need information to understand what is currently being done well and what is being done wrong so it can be reduced or eliminated.

There are two perspectives regarding information as an asset: an asset-centric approach and a security-centric one (Higson & Waltho, 2009). The authors explained that the first perspective "is a proactive approach that manages information in the same way as other assets such as pounds, people and property. It is successful because it focuses on the exploitation of information assets and, because we naturally take more care of what we value, it also leads to greater protection of those assets" (Higson & Waltho, 2009, p. 1). The authors then described the second perspective as having a tendency

to foster a reactive, technical-specialist focus. Organizations that adopt this approach generally restrict access to data to the privileged few and as a result they also restrict the potential business benefits. At the same time, because they encourage a more mechanistic, tick-box approach to security, they often fail to prevent the quality and security lapses that triggered the attention in the first place. This compliance-led approach is more common in the public sector, where highly-publicized security lapses have helped to create and reinforce a safety-first mindset and where the incentives and rewards for exploiting information assets are less prevalent. (Higson & Waltho, 2009, p. 1)

This second approach is the perspective in use in the Army. In order to achieve the vision of getting a modern Army, the information culture and practice could be changed to the first approach.

### b.    Strategy

The Congruence Model identifies two levels of strategy. This complies with the description made of the classical methodology enterprises put in practice to achieve their goals. There is a corporate strategy level and business strategy. The first one is the long-term direction and the other the execution level. Strategy is the realization of the vision. The statement of the Army's vision calls for a modern Army that is committed to national development. Adopting and implementing new and proven organizational practices that improve efficiency and add value is a way to achieve that vision as well. If the army can master the implementation and use of these practices, it can establish itself as a source of knowledge and an example of how to implement organizational best practices, fostering the use of these methodologies and contributing to national development, as stated in the mission.

### c.    Outputs

Nadler and Tushman defined outputs as the main purpose of every organization (Nadler & Tushman, 2003). They are made of activities, behaviors, and performances developed in three levels. These levels are the organization as a whole, the units and components of the organization, and the individuals. According to Nadler and Tushman, an organization must precisely define "what output is required at each level to meet the

overall strategic objectives and then" collect necessary "data to measure what output is actually being achieved" (Nadler & Tushman, 2003, p. 9)

In this thesis, the focus is put on the supporting element of the organization. Operational performance is particularly important to commanders. Although they are related to and interact with the supporting element, they need metrics that have a different scope. From the organizational perspective, metrics for the supporting element are more related to management tasks. In this sense, applying the definitions of the Congruence Model (Nadler & Tushman, 2003), the output can be assessed by "the goods and services provided, revenues, budget savings, personnel administration, [and] service outcomes" (Nadler & Tushman, 2003, p. 5); other features such as "the performance and behavior of the divisions, departments, and teams that make up" (Nadler & Tushman, 2003, p. 5) the supporting element organization can be assessed as well. Finally, "the behavior, activities, and performance of the people within the organization" (Nadler & Tushman, 2003, p. 5) can also be measured. All these measures and assessments are currently done, but if a standardized methodology is used, if the best practices are chosen, management can be improved and the best results will be obtained.

### d.     The Organizational Transformation Process

Inputs are introduced into the organization, and the organization delivers a product. Some of the outputs consist of a desired performance and a related effectiveness produced by the organization as a whole, its components and the individuals. Outputs are the purpose of every organization. They are made of activities, behavior, and performance of the organization in three levels: the organization as a whole, the units and components of the organization and the individuals (Nadler & Tushman, 2003). The transformation from the inputs to the outputs is done by processes performed by four organizational components: the work, the formal organization, the people and the informal organization. Having a deep knowledge of how these components are related to the others is of major importance. The final performance depends on the alignment of these organizational components, how they fit to each other. That means that the tighter

they fit—the greater the congruence in the organization—the closer will be the achieved performance to the desired one.

Strategy goes from inputs to outputs through all the organizational components. It is desired that all the organizational components have a high degree of congruence. Of most interest for this thesis is the path that goes through the work and formal organization components. This path is linked by applications, data, networks and technology. It is therefore crucial that their design and implementation take into account the desired congruence, to get closer to the desired final state.

Figure 11 provides an example of a current organizational process, a maintenance activity. In this diagram, the inputs of unit maintenance are the requests that other units send to maintain their equipment. The process is made of many forms and documents that must be filled, approved, signed and stored. Then, the work is performed by the formal and informal organization. The output is the equipment restored to adequate operational conditions. The strategy has been previously set by the Army Headquarters, delivered by means of plans, programs and policies. This strategy set priorities and assigned the necessary budget. Technology has only two entry points, identified by the two blocks in blue. It is not part of the process. It takes the form of an application that provides information to some level. This information through technology is limited only to authorized users. Information and IT are neither applied on the whole process nor part of the organization transformation process. Information and IT should be available to every stakeholder according to their need in real time.
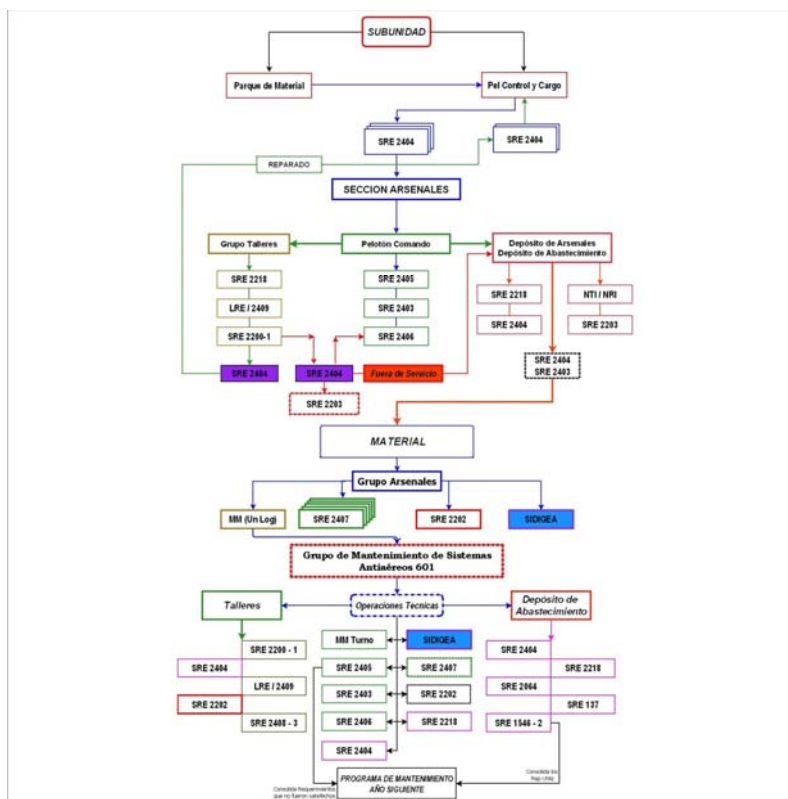
Diagram built from various manuals and directives.

Figure 11.    Maintenance Process and Flowchart.

## B.    THE IDEAL STATE (THE TO-BE): SELECTING AN OPERATIONAL MODEL AND IMPLEMENTING A FOUNDATION FOR EXECUTION

A taxonomy and a model are useful to diagnose the current state of an organization. Metrics can be used to have a measure of some symptoms, some warning signs of an organization that could be commonly known and mentioned, but which are not weighted properly with an adequate unit of measure. Some of these warnings, as described by Ross et al. (2006, pp. 5–6), are the fact that several components of the organization have different answers or develop a different solution to the same requirements; reporting requirements that have no standards and usually depend on the authority that issues them; some permanent tasks that seem to start from the beginning when new authorities are appointed; IT that consists of individual solutions instead of capabilities, with no defined standards for hardware and software; information that is not considered as a strategic asset; and processes that are neither modeled nor systematized,

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resulting in different processes performing the same activity and requesting the same information. Many more issues can be mentioned.

To find a solution to these problems, the organization has to decide which processes must perform well and then select and implement the required IT systems to digitize them (Ross et al., 2006, p. 2). In this way, the routine tasks are automated, and IT and information become assets. At the strategic level, managers can focus on long-term planning. At the execution level, greater agility is achieved and routine outcomes become predictable. Ross et al. (2006, p. 2) defined this selection as the building of foundation for execution. To achieve it, an organization needs to get insights into the following disciplines: operating models, enterprise architecture and IT engagement models. This thesis proposes how to choose and implement these three disciplines in the current state of the Argentinian Army.

1.      **Enterprise Architecture**

There is currently an Enterprise Architecture in use in the Argentinian Army. This is the starting point to consider. There are several frameworks that can be chosen and adopted later such as TOGAF, but in order to do that, some considerations need to be taken into account. It is probable that an Enterprise Architecture framework will be selected by the National Government as part of a modernization plan for public agencies. It could also be selected by the Ministry of Defense, as part of a general plan to optimize the armed forces. The other possibility is that the Army proposes the adoption of a framework that can later be extended to other agencies. Whichever will be the result, Enterprise Architecture selection and adoption will be decided at the highest management level.

2.      **Operational Model**

a.      *Selecting a Model*

Four operating models have been previously described. The operating models are defined according to their level of integration and standardization. Standardization of processes means that they will always be executed the same, independently of who is in

charge. Integration means that standardized data is shared among the organizational components. The operating model characterizes a broad view of how the organization will implement the selected strategies (Ross et al., 2006, pp. 27–28).

Considering the current architecture of the Army, this thesis proposes to adopt a unification model for the support component of the Army. The support component of the Army will always perform the same activities and processes, according to the authorities who are in charge. It can be considered to be a supplier for the operational components of the Army. The operational components of the Army will perform the role of customers. The technology selected will link and automate their processes.

The unification model has the following characteristics: customers and suppliers may be local or global, business processes are integrated, units have overlapping operations, management is centralized, standardized processes are designed at the highest level, databases are centrally mandated, and IT decisions are made centrally. These characteristics fit the Army organizational components. Fitting is one of the desired features in an organization. Ross et al. described the overall benefit of the unification model: "When organizational units are tightly integrated around a standardized set of processes, companies benefit from a Unification model" (Ross et al., 2006, p. 36). The unification operational model has to be implemented in the operational element of the Army as well, but in this case, different operating models can be applied at the lower levels, according to their particular demands. In this way, each operational division of the Army will implement a unification model at the top level, and other operational models can be implemented in the dependent organizations.

In order to implement a unification model, the first step needed is to identify which are the current levels of integration and standardization. This can be done by responding to the two questions that Ross et al. presented:

> To what extent is the successful completion of one business unit's transactions dependent on the availability, accuracy, and timeliness of other business units' data? (Ross et al., 2006, p. 30)

> To what extent does the company benefit by having business units run their operations in the same way? (Ross et al., 2006, p. 30)

These questions have to be answered by the strategic-level management. All their members and staff should work together to conclude which is the current situation, and from it, design the road to the desired model. In this way, the first benefit is gained: management direction gets better and complete insights are gained for developing capabilities instead of individual solutions.

### b. Implementing the Model

The implementation of the selected operating model has to be made by means of the current Enterprise Architecture. The information about the current Enterprise Architecture has to take the form of a high-level document that summarizes the common shared view, has to be easy to understand, and must gather all the necessary information in the shortest way possible. It must include the core business processes, the shared data, key technologies and key stakeholders (Ross et al., 2006, p. 51). A simple diagram can be very useful for this purpose and present all that information in a reduced form so it can be easy to work from it without missing important information.

Ross et al. (2006, p. 53) described a core diagram for a unification operating model. First, key customers have to be identified; then the fundamental processes that have to be standardized and integrated must be enumerated. Next, the shared data that is used to serve stakeholders through processes must be listed; finally, the key selected technologies that support the previous purposes must be presented. All these elements are presented in a diagram that shows all the components of current Enterprise Architecture with the selected components of the unification model. The diagram must show the resulting standardized and integrated organization, the processes and the shared data and technology they use.

For the Argentinian Army, this thesis proposes the following elements for this model:

- Core processes: the processes performed by the fourteen directorates of the support element of the Army. These are the processes that each directorate performs with the units of the operational element of the Army and among them.

- Key Stakeholders: The main ones are the Army authorities, the directors and commanders in particular, and every member of the Army in general, as users who provide and request information from the system. Providers of goods and services and the population that request some type of support are other key stakeholders.

- Shared data: Every element of the support element generates information through data they request from the operational units. The operational units generate data and require information as well. There is a flow of data and information that goes in both directions. Currently, this flow of information is not shared. The unification operational model demands shared information updated in real time, linking all the elements at every level of decision. How information will be shared and what information can be shared at every level must be properly designed.

- Technology: Networks are currently in use. They were adopted as individual solutions. New practices and technologies should be introduced in order to introduce the notion of information as an asset, the importance of information security, and the benefits it can provide.

IT should go from local solutions to shared capabilities along the entire organization. In the first stages, the adoption and implementation of a given technology is based on the criteria of finding a solution for a particular problem at the lowest cost possible. Although these solutions provide a local and immediate advantage, as long as many of these solutions are implemented, they work in isolation and cannot communicate to each other. Eventually, linking them becomes complex and expensive, and standardization and integration are blocked. In order to overcome these limitations, IT has to be standardized along the whole organization. IT has to continue providing process automation but now as a shared infrastructure, common to every component of the organization. Standardization can reduce costs because IT administration is the same for every unit, processes that belong to different units can be linked more efficiently, and the path towards the unification model is facilitated.

To effectively implement IT standardization in the Argentinian Army, the role of Chief Information Officer (CIO) has to be created. The term was introduced for the first time in 1981 as the "senior executive responsible for establishing corporate information policy, standards and management control over all information resources" (Synnott & Gruber, 1981). Lawry, Waddell, and Singh described the CIO "as a manager, and not just

a technical expert" (Lawry, Waddell, & Singh, 2007, p. 58-2). The authors then explained that "the CIO role within the public sector is still at a formative stage whereas in the private sector it is well developed" (Lawry et al., 2007, p. 58-2). It has become more prominent, however, as a consequence of an "increased dependence of governments on Information Technology for internal management, delivery of services to citizens and meeting the demands of the digital environment" (Lawry et al., 2007, p. 58-1).

The Army should have to have a graphical representation not only of the organizational structure but also of all the processes it performs and the associated "inputs, outputs, data, objects, interactions, locations, [and] networks" (Satzinger, Jackson, & Burd, 2011, p. 234), as well as devices and other significant components. Models provide an important aid to achieve this scope. Models are a "representation of an aspect of the real world" (Satzinger et al., 2011, p. 234). Information-related systems are not very tangible, so models for them are complex and hard to achieve, but there are tools that help to create them. Satzinger et al. (2011, p. 235) enumerated some of these tools used to develop systems: flowcharts, data flow diagram, entity-relationship diagram, structure chart, use case diagram, class diagram and sequence diagram.

These tools take the form of software that is used in systems development. After getting the results, these tools can be applied in one of two available approaches to modelling: the structured approach and the object-oriented approach. The structured approach is made up of "structured analysis, structured design and structured programming techniques" (Satzinger et al., 2011, p. 236). In the object-oriented approach, information systems are viewed as a "set of interacting objects that work together to accomplish tasks and goals" (Satzinger et al., 2011, p. 241)**.**

### 3.    Path from Present to Desired State

The desired state of an organization is one in which the strategies, processes and resources are aligned by means of management and technology practices. Management and technology practices provide a holistic and integrated view of strategy, processes, information flow and resources. When this state is achieved, the organization's performance can be improved because of the existence of an authority reference and the

"best practices" are set. Quality, agility, efficiency, risk management, new technology adoption and adaptation to change can be obtained (Bernard, 2012, p. 33). In order to achieve a desired state of this type, this thesis proposes a methodology to go from the present state to the desired state.

The first step to achieve a desire state is to know the present state, which is the current situation of its strategy and execution. The way in which processes, information and technology are arranged and managed can be assessed by the use of a taxonomy. This thesis proposes to use the Zachman Framework to get the picture of how the organizational components are managed, who they target and what specific issues are being addressed. Then, an organizational model like the Congruence Model can be applied to get insights of how the organization goes from the inputs to the outputs it must deliver. The strategy and transformation processes are included and described in this model. In this way, an holistic view of the current state of the organization is provided, and the issues that are not efficient and need to be improved can be identified.

After assessing the organization, an operational model has to be selected. This thesis proposes the adoption of the unification model. This operational model has the highest levels of integration and standardization. It should be implemented in the support element of the Army and could be extended to the operational elements. Both elements have a relationship of suppliers and customers, so the thesis considers that the unification model is the most adequate operational model to adopt.

The operational model must be implemented by making use of the Enterprise Architecture the organization has developed. As defined, Enterprise Architecture is the organizing logic for processes and IT infrastructure. The Argentinian Army has a legacy architecture. A formal methodology such as TOGAF has not been applied. At this point, it is necessary to note that Enterprise Architecture is still a new topic in the country and the region. In the 2015 membership TOGAF report, only five companies from Mexico, six from Brazil and one from Peru are mentioned as members. The Argentinian Army could become a pioneer, getting expertise on this methodology and being a reference organization on this practice. At the same time, the vision of being a modern organization will be achieved.

Information is one of the most critical assets in this methodology. Achieving a high degree of standardization and integration requires information to be digitized. Digitizing information is a technical problem. Some actions have been made in that direction. Many manuals, forms, and data have been digitized. They are available online through the Army's intranet. Many others documents have been scanned and made available. A standard format must be selected and applied but that could be the easiest task. The creation of an information culture is more important and complex. On the highest command levels, the shift from a "classical theory on information that focuses on the use of information for control" to a new "theory of information that focuses on learning and adaptation" (Higson & Waltho, 2009, pp. 4–5) should be made. In this way, an organization can go from the use of data to improve the reaction time to "fail and fix," to analytics that enable users to "predict and prevent" (Higson & Waltho, 2009, p. 3). Considering information as an asset rather than as a technology specialization, leadership on every level of the organization can benefit from it. The creation of this culture can be gained by including this topic in the educational activities of the Army. Every member of the Army has to go through many courses along their career. These courses are a good opportunity to introduce these concepts and create an information culture.

The changes described can be implemented if there is an authority position in charge of it. In private organizations, this is the role of the Chief Information Officer (CIO). The Army should appoint this position and assign responsibility and resources to it. It is not a technical position but a management position. It designs and proposes the information policies that are necessary to get to the desired state. This position will have a fundamental role in the adoption of the new organizational practices. According to Higson and Waltho, "The CIO's role is less about managing the technology and more about expert commissioning and ensuring that the outputs from the technology are turned into information and put to good use by the business. In businesses that do this, IT is regarded as a strategic value generator rather than a cost center" (Higson & Waltho, 2009, p. 16).

If the steps described can be achieved, the Army will transform into an organization that will be a modern one, capable of adapting to an ever-changing

environment, developing capabilities instead of individual and temporary solutions, achieving agility and making the best use of its resources and budget.

## C.   SUMMARY

In this chapter, the thesis proposed to assess the current state of the Army from an organizational point of view using various methodologies. First, the Zachman Framework would be used to obtain the picture of how the organizational components are managed, who they target and what specific issues are being addressed. Then, it has been proposed to employ the Congruence Model organizational model to get insights of how the organization goes from its inputs to its outputs through strategy and the transformation process. In order to improve processes and the overall performance, the thesis proposed to use the current architecture until a formal one will be selected. This architecture will be the basis to select an operational model and implement a foundation for execution. The operational model proposed is the unification model, in which the highest levels of integration and standardization are desired. If the supporting element is considered as a provider, then the operational element is considered to be a customer. This model is the best model to achieve the best results. Because IT and technology are considered from a management point of view, the thesis proposed the creation of the role of Chief Information Officer (CIO). If all these elements are present and there is an active participation of the highest authorities of the Army, the path from the as-is to the to-be is assured.

# V.   EXPECTED OUTCOMES AND CONCLUSIONS

If the Army succeeds in the adoption of an operational model, the implementation of an Enterprise Architecture, achieving a foundation for execution, it will develop capabilities instead of solutions. In that sense, it will be ready to adopt new technologies and make use of them. The vision of a modern organization can be achieved by making use of new technologies, innovation and a learning mindset. The way to do that is by studying and selecting which technologies are interesting to the organization, what impact they will cause and which benefits will be gained.

## A.   NEW TECHNOLOGIES TO EVALUATE AND ADOPT

A solid architecture will transform the Army into a modern organization, capable of adapting to an ever-changing environment. The organization will develop capabilities instead of individual and temporary solutions, gaining agility and making the best use of its resources and budget. At the same time, new tools must be incorporated for two main reasons. The first one is that new practices and the generation of digitized information will, in turn, require exploitation with new and innovative technology. The second reason is to get closer to the desired state of being a modern organization. In that sense, the implementation of new technologies can attract and motivate people to join the Army.

### 1.   Big Data

Data is generated in great volumes and is originated by many different types of sources. Data is generated by human interactions and by many autonomous devices. Data can be generated by human activities, machine-to-machine interactions, web and social media and online transactions. Data is different today than it used to be. If a new information culture will be implemented, enormous datasets will be available. The information systems can be used to analyze current and past activities and to predict future events. These analyses are made by two system applications: reporting and data mining.

Reporting applications perform the following tasks:

- Filter

- Sort

- Group

- Simple calculations

- Entities classification

- Current business status summary

- Current business status to past or future comparison

- Critical report delivery (Kroenke & Auer, 2014, p. 537)

- Data mining applications are used to:

- Perform what-if analyses

- Make predictions

- Facilitate decision making (Kroenke & Auer, 2014, p. 537)

These two applications, reporting and data mining, could be an invaluable aid to the organization, helping to improve its performance. At the same time, they could play an important role in an inherent military activity, command and control. The ways in which these applications can improve command and control is an area for future Army research.

## 2. Cloud Computing

Enterprise Architecture demands that the strategy, processes and technology are aligned within the organization. The adoption of an operational model imposes some conditions as well. The unification model proposed by this thesis aims to implement the highest levels of integration and standardization. In order to achieve this state, considerations have to be taken into account regarding applications and their configuration and access, software usage, data storage, computing platforms and infrastructure. All of these services are provided by cloud computing technology.

Cloud computing is a technology that provides services through a network. The service hosting provider is located remotely. In this way, cloud computing can help to

implement the proposed operational model and achieve the standardization and integration levels required. According to Creeger, "Cloud Computing refers to manipulating, configuring, and accessing the applications online. It offers online data storage, infrastructure and application" (Computing & Creeger, 2009, p. 9). It can also help to implement and increment security practices.

The most important models for cloud computing are:

- Deployment Models: define the type of access to the cloud

- Service Models: the reference models on which the Cloud Computing is based (Computing & Creeger, 2009, p. 10)

Deployment Models can have any of four types of access:

- Public: systems and services easily accessible by the general public

- Private: allows systems and services to be accessible within an organization. It offers increased security because of its private nature.

- Hybrid: mixture of public and private cloud. Critical activities are performed using private cloud while the non-critical activities are performed using public cloud.

- Community: allows systems and services to be accessible by groups of organizations (Computing & Creeger, 2009, p. 10)

Service Models can be categorized into three basic types:

- Software as a Service (SaaS): provides a variety of software applications as a service to end users

- Platform as a Service (PaaS): provides a program executable platform for applications development tools

- Infrastructure as a Service (IaaS): provides the fundamental computing and security resources for the entire cloud (Computing & Creeger, 2009, p. 11)

Because the Army can be considered as a public agency, although it needs high levels of security in many areas, the hybrid deployment model can be the adequate selection to implement IT to achieve the desired operational model. The service model to implement can go in an incremental way, from Software as a Service to Infrastructure as a Service.

There are many other technologies that the organization must consider. Today, innovation occurs at a fast pace. Some technologies will be significant and have an immediate impact on the society. The Army is part of the society and has relations within it. As with any other organization, the Army has to monitor which changes are currently being developed, what outcomes they produce and how they will be incorporated. Some of these new technologies that are related to military activities are the proliferation of Autonomous and Unmanned systems, the use of Artificial Intelligence, the spread of the Internet of Things and Robotics.

## B.    CULTURAL IMPACT

If most of the routine processes and tasks are automated by means of the Enterprise Architecture and the operational model implemented, managers and leaders at every level of the organization can focus their efforts on new challenges. A change of this characteristic will have a great impact on some areas of the organization, in particular on the people and the overall environment.

Regarding education, a shift to a digitized information environment and culture demands higher levels of specific knowledge. Army members on every level will need to learn about information science, security, cyber defense, and many other topics. The concepts of confidentiality, integrity and availability of information must be valued and well understood. Threats and vulnerabilities have to be considered at every level of command. Going from direct relations to interactions based on IT means that things like emails, chats, and digital signatures to issue valid orders are topics that will have a deep cultural impact. This thesis proposes to evaluate, assess and implement these resources.

Regarding the organization as a whole, it is clear that it is important to create a learning environment to rapidly adapt to changes. An organization learns through its members while they experiment, work and make mistakes. This learning environment requires a new mindset. This mindset is given by an environment where every member is given a psychological safety place where they can test, research, experiment and learn while performing routine tasks. Because of the ever-changing environment and the rapid technology innovation, today's leaders are not the ones who know what to do in every

situation. Instead, leaders set the general direction, learn from their people and provide the conditions to arrive at the desired outcome in the shortest time.

## C.    EXPECTED BENEFITS

Enterprise Architecture can provide to the Army the fundamental blocks to its activities. If the routine tasks are digitized and automated, the organization can rapidly adapt and respond to new challenges and changes. This environment is the norm today. Innovation, new technologies, new organizational procedures, and globalization are part of the daily activities. The Army can be seen as a defense force that interacts with other regional forces. At the same time, it can be seen as a public agency that provides services to the nation and the citizens. One of the most important characteristics the organization needs is agility to rapidly adapt and respond to unexpected requirements. Some scenarios can be planned in advance; other scenarios take place with no warning.

Implementing the right architecture can help to not only accomplish the missions assigned, but to be successful by presenting and applying modern practices, as stated in the Army's vision. Technology will be used as an enabler rather than a solution. At the same time, these best practices can motivate highly skilled and educated people to join the organization.

Every member of the Army joined the organization for vocational reasons. Creating an environment and providing their best to have an outstanding organization that excels at its mission is the duty of all soldiers. Enterprise Architecture can become the environment where all these goals can be achieved.

## D.    FINAL CONCLUSIONS

Modern organizations make use of modern methodologies to improve their efficiency, enhance their outcomes and gain agility. These methodologies include Enterprise Architecture, the selection and implementation of an operational model and the achievement of a foundation for execution.

The Argentinian Army has the vision of being a modern organization. The Army is always looking to modernize the operational elements. This thesis proposes to

modernize its organizational processes by adopting and implementing modern methodologies.

In order to implement these methodologies, the current state of the organization, the as-is, has to be assessed. Then the desired state, the to-be, has to be selected and implemented.

The methodologies provide a means to automate and digitize routine tasks. This automation and digitation allows the organization to improve efficiency. At the same time, leaders of the organization at every level can focus on opportunities and changes in the current environment.

The Army currently has an architecture; the thesis proposed a possible operational model and foundation for execution. The IT infrastructure and technology to implement these methodologies are available. An information culture and environment has to be implemented.

In order to implement an information culture and environment, in which information is an asset that can provide capabilities instead of solutions, some changes must be introduced.

The most important changes to be introduced are the creation of the role of Chief Information Officer and a cultural change. The cultural change can be implemented through all the courses that are mandatory for all Army members along their careers.

The cultural change should aim to introduce the idea of a learning organization, in which information is as important as any other operational asset. Command and control will be shaped by these factors.

The methodologies, the role of CIO and the cultural change can be the basis to achieve agility that can face unexpected opportunities, changes in the environment. At the same time, they are the best way to introduce new technologies.

From all these considerations, we can conclude that a modern enterprise methodology can be implemented. There is a path that goes from the current architecture through the selection and implementation of an operational model to achieve a foundation

for execution. In this way, the Army can benefit itself from these practices and at the same time can benefit the society, making the best use of its resources to accomplish its mission and execute tasks to support national security.

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# LIST OF REFERENCES

Argillander, T. (2012). Strategic architecture for technology industry. Retrieved from http://www.fimecc.com/sites/www.fimecc.com/files/120614_Strategic_Architectu re_White_Paper.pdf

Atkinson, S. R., & Moffat, J. (2005). *The agile organization: From informal networks to complex effects and agility*. Washington DC: Assistant Secretary of Defense (C3I/Command Control Research Program).

Bahill, A. T., Botta, R., & Daniels, J. (2006). The Zachman Framework populated with baseball models. *Journal of Enterprise Architecture, 2*(4), 50–68.

Bernard, S. A. (2012). *An introduction to enterprise architecture*. Bloomington: AuthorHouse.

Bredemeyer, D., Malan, R., Krishnan, R., & Lafrenz, A. (2003). Enterprise architecture as business capabilities architecture. *Bredemeyer Consulting*. Retrieved from http://www.bredemeyer.com/pdf_files/Presentations/EnterpriseArchitectureAsCa pabilitiesArch.pdf

Cramer, M. L. (1997). *Measuring the value of information*. Proceedings of NCSA InfoWarCon, 97.

Cuenca, L., Ortiz, A., & Boza, A. (2010). Business and IS/IT strategic alignment framework. In *Emerging Trends in Technological Innovation* (pp. 24-31). Springer Berlin Heidelberg.

Computing, C., & Creeger, M. (2009). Cloud computing: An overview.*Distributed Computing*, *7*(5).

Ejercito Argentino. (2016). Retrieved from http://www.ejercito.mil.ar

Executive Office of the President of the United States. (2007). *FEA consolidated reference model document version 2.3*. Washington, DC: Author.

Federal Enterprise Architecture Program Management Office, OMB. (2007, November). FEA practice guidance. Retrieved from https://www.whitehouse.gov/sites/default/files/omb/assets/fea_docs/FEA_Practice _Guidance_Nov_2007.pdf

Gallagher, R., Appenzeller, T., & Normile, D. (1999). Beyond reductionism. *Science, 284*(5411), 79.

Goolsby, R. (2015). *Shaping the battlefield through communication: Tactical & strategic maneuver through social media*.

Higson, C., & Waltho, D. (2009). *Valuing information as an asset* (White paper). London: SAS.

Hoogervorst, J. A. (2009). *Enterprise governance and enterprise engineering.* Diemen (Netherlands): Springer Science & Business Media.

Johnson, G., Scholes, K., & Whittington, R. (2008). *Exploring corporate strategy: Text and cases.* Essex (England): Pearson Education.

Jones, R. H. (2000). *Reductionism: Analysis and the fullness of reality.* London (England): Bucknell University Press.

Josey, A. (2009, January). TOGAF 9, enterprise edition. Retrieved from http://www.opengroup.org/onlinepubs/7699909599/toc.pdf

Kroenke, D., & Auer, D. J. (2014). *Database processing.* New Jersey: Prentice Hall.

Lawry, R., Waddell, D., & Singh, M. (2007, June). Roles, responsibilities and futures of chief information officers (CIOs) in the public sector. In *Proceedings of European and Mediterranean Conference on Information Systems (EMCIS)* (pp. 24–26).

Libro Blanco de la Defensa. (2015). Ministerio de Defensa. Retrieved from http://www.libroblanco.mindef.gov.ar

Nadler, D. A., & Tushman, M. L. (2003). The Congruence Model: A roadmap for understanding organizational performance. Retrieved from http://ldt.stanford.edu/~gwarman/Files/Congruence_Model.pdf

The Open Group. (2016). Welcome to TOGAF version 9.1, an Open Group standard (English version). Retrieved from http://pubs.opengroup.org/architecture/togaf9-doc/arch/

Op't Land, M., Proper, E., Winter, R., Waage, M., Tribolet, J., Ross, R. G., & Cloo, J. (2009). *Enterprise Architecture: Creating value by informed governance.* Berlin: Springer-Verlag.

Raymond, B. (2010), I*nvestigating the Relationship between IT and Organizations: A Research Trilogy.* Dissertation, Georgia State University. Retrieved from http://scholarworks.gsu.edu/cis_diss/43

Ross, J. W., Weill, P., & Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution.* Boston: Harvard Business Press.

Satzinger, J., Jackson, R., & Burd, S. D. (2011). *Systems analysis and design in a changing world.* Boston: Cengage Learning.

Sessions, R. (2007). A Comparison of the Top Four Enterprise Architecture
　　　　Methodologies. Retrieved from http://objectwatch.com/white-papers

Software Engineering Standards Committee. (2000). *IEEE recommended practice for
　　　　architectural description of software-intensive systems*. Technical Report IEEE
　　　　Std 1471-2000, IEEE Computer Society.

Synnott, W. R., & Gruber, W. H. (1981). *Information resource management:
　　　　Opportunities and strategies for the 1980s*. New York: John Wiley & Sons, Inc.

Tarabanis, K., Peristeras, V., & Fragidis, G. (2001). Building an enterprise architecture
　　　　for public administration: A high level data model for strategic planning. *ECIS
　　　　2001 Proceedings,* 116.

Wolf Management Consultants. (2015). Building enterprise capabilities: A framework for
　　　　capabilities-based competition. Retrieved from
　　　　http://www.wolfmotivation.com/programs/building-enterprise-capabilities-a-
　　　　framework-for-capabilities-based-competition

Zachman, J. (2008). Zachman International. Retrieved from
　　　　https://www.zachman.com/about-the-zachman-framework

Zachman, J. (1987). A framework for information systems architecture. *IBM Systems
　　　　Journal, 26*(3), 276–292.

Zachman, J. A. (1996). Concepts of the framework for enterprise architecture. *Los
　　　　Angels, CA*.

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